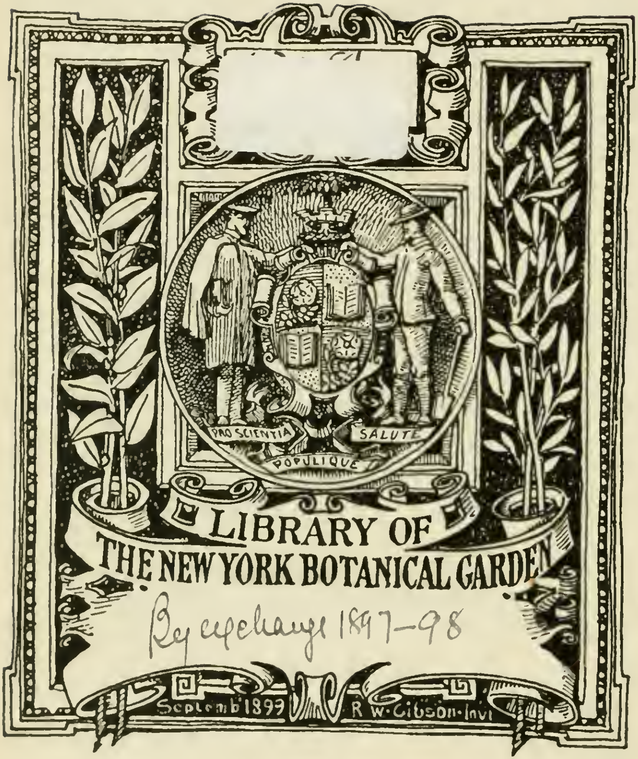
SHOUT
SHARE
IT


PRO SCIENTIA
POPULIQUE
SALUTE
Septemb 1899
R. W. Gibson Invt

LIBRARY OF
THE NEW YORK BOTANICAL GARDEN

By exchange 1897–98

NEW YORK
BOTANICAL GARDEN,
GIVEN BY N. L. BRITTON.

BULLETIN NO. 7.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

2nd ed. [illegible]
3rd ed. [illegible]

AMERICAN GRASSES.

(ILLUSTRATED.)

BY

F. LAMSON-SCRIBNER,
AGROSTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.

XB
[illegible]
[illegible] 7-11

LETTER OF SUBMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., January 22, 1897.

SIR: I submit herewith a number of illustrations of native and introduced grasses, with brief descriptions and notes upon the distribution of each, based upon the collections of the Department, and recommend their publication as Bulletin No. 7 of this Division. These illustrations were primarily designed to illustrate a Handbook of North American Grasses, in which all the North American species are to be figured, but as it will be some time before the remaining figures can be engraved, it has been suggested that three hundred of those now completed be published, in order to render them immediately useful and available to others. If the present form of publication had been orginally contemplated, a different selection of figures would doubtless have been made. This is of small importance, however, as it is hoped to publish illustrations of all the species in the near future, and it is for this reason that references to the detail drawings are omitted. Notes upon the uses and value of the species of economic interest were published in Bulletin No. 3 of this Division, "Useful and Ornamental Grasses."

The drawings are all from carefully selected specimens, the habit sketches being made by Mr. A. H. Baldwin. The enlarged details were drawn by myself, with the exception of a few which were made by Miss M. D. Baker. The engraving is the work of Mr. L. S. Williams and Mr. George P. Bartle. The work has all been done in the office of the Division, with the exception of that performed by Mr. Bartle.

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

HON. CHAS. W. DABNEY, Jr.,
Assistant Secretary of Agriculture.

INTRODUCTION.

In order to make the present publication more useful to students of grasses, the order Gramineæ and the several tribes into which the order has been divided by our best authorities are here briefly characterized. Under the tribes the genera which are native or have been introduced are enumerated, and those having species figured in this bulletin are marked with an asterisk (*).

GRAMINEÆ—GRASSES.

Characters of the order.—Fibrous-rooted, annual or perennial, herbaceous (rarely woody) plants, with usually hollow, cylindrical (rarely flattened) and jointed stems (*culms*) whose internodes for more or less of their length are enveloped by the sheath-like basal portion of the two-ranked and usually linear, parallel-veined leaves; flowers without any distinct perianth, hermaphrodite or rarely unisexual, solitary or several together, in *spikelets*, which are arranged in panicles, racemes, or spikes, and which consist of a shortened axis (the *rachilla*) and two or more chaff-like, distichous imbricated bracts (*glumes*), of which the first two, rarely one or none or more than two, are empty (*empty glumes*); in the axil of each of the succeeding bracts (excepting sometimes the uppermost) is borne a flower (hence these are named *flowering glumes*). Opposed to each flowering glume, with its back turned toward the rachilla, is (usually) a two-nerved, two-keeled bract or prophyllum (the *palea*), which frequently envelops the flower by its infolded edges. At the base of the flower, between it and its glume, are usually two very small hyaline scales (*lodicules*);

rarely there is a third lodicule between the flower and the palea; stamens, usually three (rarely two or one, or more than three) with very slender filaments and two-celled, usually versatile anthers; pistil with a one-celled, one-ovuled ovary, and one to three, usually two, styles with variously branched, most frequently plumose, stigmas; embryo small, lying at the front and base of the seed, covered only by the thin pericarp: fruit a caryopsis, rich in albumen. (In *Sporobolus* and *Eleusine* the thin pericarp is free from the seed.)

Number of species.—There are about thirty-five hundred known species of grasses, varying in size from the moss-like *Coleanthus* of the North to the tree-like bamboos of the Tropics, which tower to the height of 30 m. or more; and ranging in distribution from Kerguelen Land on the South to the extreme limit of vegetation beyond the Arctic Circle. There is no order of plants more widely distributed, or existing under a greater diversity of soil and climate, and no other order presents such a vast number of individual plants or is so important and directly useful to man.

SERIES A.—PANICACEÆ.

Spikelets one- rarely two-flowered; when two-flowered the second or terminal one is perfect, the first or lower one being either staminate or neuter; rachilla articulated below the empty glumes, the spikelets falling from the pedicels entire, either singly, in groups, or together with the joints of an articulate rachis. The first six tribes belong to this series.

TRIBE I.—*Maydeæ.*

Spikelets unisexual, the staminate forming a part of the inflorescence with the pistillate, or each in a separate inflorescence on the same plant: flowering glumes hyaline or much less firm in texture than the outer ones; axis of the female spikelets usually articulated.

This is a small tribe, numbering only sixteen species classed in seven genera. They are nearly all natives of the Tropics, chiefly in the Old World. Indian corn, or maize, is our best known example of the Maydeæ.

Euchlæna Schrad.
Zea Linn.
Tripsacum Linn.*

TRIBE II.—*Andropogoneæ.*

Spikelets in spike-like racemes, two at each joint of the articulate rachis, one sessile and hermaphrodite, one pedicellate, the latter hermaphrodite, staminate, neuter, or reduced to the pedicel alone; glumes usually four, the first and second empty, larger and much firmer in texture than the others, the third usually empty, with a staminate flower in its axil, very rarely awned, the fourth or flowering glume hyaline, usually awned, awn usually twisted or geniculate.

This tribe contains about four hundred species divided among twenty-nine genera, of which the genus *Andropogon*, with one hundred and ninety species, is by far the largest and probably the most important. Sugar cane belongs to this tribe in the genus *Saccharum*. Our best known representatives of the Andropogoneæ are the common broom sedge, *Andropogon virginicus*, and the big blue stem, *Andropogon provincialis*. In the same genus are now classed our species of sorghum. The members of the tribe are distributed throughout the tropical and warmer regions of both hemispheres.

Imperata Cyr.*
Miscanthus Anderss.
Saccharum Linn.
Erianthus Michx.*
Manisuris Linn.*
(*Rottboellia* Linn. f.)
Hackelochloa Kuntze.*
(*Manisuris* Sw. not Linn.)
Trachypogon Nees.
Elionurus HBK.*
Andropogon Linn.*

TRIBE III.—*Zoysieæ.*

Spikelets solitary or in groups of two to eight, each group falling as a whole from the continuous rachis, usually one-flowered, hermaphrodite, or staminate and hermaphrodite in the same group; flowering glume less firm in texture than the awned or awnless outer ones, which are herbaceous, chartaceous, or coriaceous; the first glume is usually larger than the second.

A small tribe, numbering about twenty-five species which represent nearly half that number of genera. Fifteen species are natives of the tropical and warmer temperate regions of America. Black grama, or *Galleta*, as the Mexicans name it, species of *Hilaria*, are our best-known representatives of the tribe.

Hilaria Kunth.*	Nazia Adans. (*Tragus* Hall).
Ægopogon HBK.	Zoysia Willd.

TRIBE IV.—*Tristegineæ.*

Spikelets all hermaphrodite, in panicles; empty glumes three, or the third with a staminate flower in its axil, herbaceous or chartaceous; flowering glumes membranaceous, awned or awnless; rachilla articulated below the empty glumes.

A small tribe of only seven genera and thirty-three species, natives chiefly of the tropical regions of the Old World. Of the few American species none extend so far north as the United States.

TRIBE V.—*Paniceæ.*

Spikelets hermaphrodite, terete or flattened on the back; glumes three or four (rarely only two); when four th[illegible] usually a staminate flower or a palea in the axil of the third; [illegible]permost or flowering glume of the hermaphrodite flower is always firmer in texture than the outer glumes, of which the first is usually smaller than the others; axis of the inflorescence not articulated, the rachilla being articulated below the empty glumes, the spikelets falling off singly from their pedicels.

This is one of the largest tribes in the order Gramineæ. It contains twenty-two genera with over six hundred and thirty species. *Panicum*, the principal genus, is the largest among grasses, numbering three hundred species. The *Paniceæ* are very widely distributed throughout the tropical and temperate regions of the world. Crab-grass and the millets are among our best known examples of this tribe.

Reimaria Flügge.*
Paspalum Linn.*
Anthænantia Beauv.
Amphicarpon Raf.*
Eriochloa Kunth.*
Panicum Linn.*
Oplismenus Beauv.
Chætochloa Scribn.*
  (*Setaria* Auct.)
Cenchrus Linn.*
Pennisetum Pers.*
Stenotaphrum Trin.*

Tribe VI.—*Oryzeæ*.

Spikelets usually much compressed laterally, one-flowered, staminate, pistillate, or hermaphrodite; empty glumes two or none, the flower being subtended by the floral glume and palea alone, the latter one-nerved and regarded by some as a second glume; stamens frequently six; axis of the inflorescence not articulated.

A small tribe of about forty species divided among sixteen genera, mostly confined to tropical America. One of the best known and most extensively used of the cereals, rice (*Oryza sativa*), belongs here.

Hydrochloa Beauv.
Pharus Lin[illegible]
Luziola [illegible]
Ziza[illegible] Doell and Asch.
Zizania Linn.
Oryza Linn.
Homalocenchrus Mieg.*
(*Leersia* Sw.)

Series B.—Poaceæ.

Spikelets one- to many-flowered, the imperfect or rudimentary flower, if any, usually uppermost; rachilla usually articulated above the empty glumes, so that these remain after the fall of the fruiting glume.[1] In spikelets with two or more flowers these are separated by a manifest internode of the rachilla, and in such cases the rachilla is usually articulated below each flowering glume.

TRIBE VII.—*Phalarideæ*.

Spikelets more or less laterally compressed, one- or rarely three-flowered; glumes five, the first two empty and below the articulation of the rachilla, the third and fourth above the articulation, usually empty, very unlike the outer ones, rarely subtending staminate flowers, sometimes reduced to mere bristles, the fifth glume with a one-nerved or nerveless palea and a hermaphrodite flower.

A small tribe, comprising six genera with about sixty species of comparatively little importance. Several of the species, sweet vernal grass and vanilla grass, are remarkable for possessing a peculiar fragrance due to their containing coumarin. Canary-grass is one of the best known members of this tribe.

Phalaris Linn.*
Anthoxanthum Linn.*
Savastana Schrank.*
(*Hierochloë* Gmelin).

TRIBE VIII.—*Agrostideæ*.

Spikelets all hermaphrodite, one-flowered with three glumes, the first two empty (very rarely wanting), usually as long as or exceeding the third or floral glume; rachilla sometimes prolonged behind the palea into a naked or plumose bristle. Palea two-nerved (one-nerved in *Cinna*), nerveless, or (in some *Agrostis* species) wanting.

---

[1] *Alopecurus*, *Cinna*, *Spartina*, and *Holcus* among our grasses, have the rachilla articulated below the first pair of glumes, and the spikelets fall off entire.

This is, next to the *Festuceæ*, the largest tribe in the order, numbering seven hundred species arranged in forty-six genera. The species are distributed throughout all the temperate and colder regions of the world and many occur within the Tropics. The genus *Agrostis*, from which the tribe derives its name and from which comes the word "agrostologist," has about one hundred species, found in all parts of the world, especially in the north temperate zone. Some of our most important meadow grasses—notably Herd's-grass and timothy—belong to this tribe.

Aristida Linn.*
Stipa Linn.*
Oryzopsis Michx.*
Milium Linn.*
Muhlenbergia Schreb.*
Brachyelytrum Beauv.*
Lycurus Kunth.
Pereilema Presl.
Heleochloa Host.*
Phleum Linn.*
Alopecurus Linn.*
Coleanthus Seid.
Phippsia R. Br.*
Sporobolus R. Br.*
Epicampes Presl.*
Polypogon Desf.
Limnodia L. H. Dewey.*
(*Thurberia* Benth.)
Arctagrostis Griseb.
Cinna Linn.*
Agrostis Linn.*
Gastridium Beauv.
Calamagrostis Roth.*
Ammophila Host.*
Calamovilfa Scribn.*
Apera Adans.
Lagurus Linn.

TRIBE IX.—*Aveneæ*.

Spikelets two- to several-flowered; outer empty glumes usually longer than the first floral glume; one or more of the floral glumes awned on the back or from between the teeth of the bifid apex; awn usually twisted or geniculate; the callus, and usually the joints of the rachilla, hairy.

A tribe comprising twenty-three genera and over three hundred species widely distributed in the temperate regions of both the Old and the New World, particularly abundant in South Africa and Australia, a few extending beyond the arctic circle.

Several of the species are valued as forage plants. Cultivated oats, *Avena sativa*, is the best-known example of this tribe.

Holcus Linn., in part.*
Aira Linn.*
Weingaertneria Bernh.*
(*Corynephorus* Beauv.)
Deschampsia Beauv.*
Trisetum Pers.*
Avena Linn.*
Arrhenatherum Beauv.*
Danthonia DC.*

Tribe X.—*Chlorideæ*.

Spikelets one- to several-flowered in one-sided spikes or racemes; these racemes digitate or fasciculate, rarely solitary; flowering glumes usually keeled, entire and unawned, or toothed, and with one or three straight awns.

A small tribe of twenty-seven genera and one hundred and fifty-five species, characterized chiefly by the inflorescence, which is nearly that of *Paspalum*. The awns when present are not dorsal nor twisted, as in *Agrostideæ* and *Aveneæ*. Chiefly natives of tropical and subtropical countries; a few are widely distributed as weeds throughout the warmer parts of the world. A number are good turf-forming grasses, and are valued for grazing purposes. One of these is the celebrated buffalo-grass of the Western plains, which is remarkable for having the staminate and pistillate spikelets separate and in unlike inflorescences, either upon the same plant (monœcious) or upon different plants (diœcious).

Capriola Adans.*
(*Cynodon* Pers.)
Spartina Schreb.*
Campulosus Desv.*
(*Ctenium* Panzer).
Chloris Sw.*
Trichloris Fourn.*
Gymnopogon Beauv.*
Schedonnardus Steud.*
Bouteloua Lag.*
Beckmannia Host.*
Eleusine Gaertn.*
Dactyloctenium Willd.*
Leptochloa Beauv.*
Bulbilis Raf.*
(*Buchloë* Engelm.)

TRIBE XI.—*Festuceæ.*

Spikelets two- to many-flowered, usually hermaphrodite, pedicellate in racemes or panicles, the latter sometimes dense and spike-like; flowering glumes usually longer than the empty ones, awnless or with one to several straight (rarely bent) awns which are either terminal or borne just below the apex.

This is the largest tribe in the order, numbering seventy-six genera and about seven hundred and twenty-five species. It contains the most important meadow grasses of the temperate regions as well as the more prevalent grasses of the higher mountains within the Tropics. The genus *Poa*, which includes Kentucky blue-grass, Texas blue-grass, etc., numbers one hundred species, and an equal number of species are included in the genus *Eragrostis.* The Fescues number eighty species, and the tribe takes its name from this genus—*Festuca.* Orchard grass, *Dactylis glomerata*, is a well-known example of this tribe.

Pappophorum Schreb.*
Cottea Kunth.*
Cathestecum Presl.*
Scleropogon Philippi.*
Monanthochloë Engelm.*
Munroa Torrey.*
Orcuttia Vasey.*
Gynerium HBK.
Arundo Linn.
Phragmites Trin.*
Blepharidachne Hack.
(*Eremochloë* S. Wats.)
Triodia R. Br.*
Sieglingia Bernh.
Redfieldia Vasey.*
Dissanthelium Trin.
Molinia Schrank.
Eragrostis Host.*
Eatonia Raf.*
Koeleria Pers.*
Catabrosa Beauv.*
Melica Linn.*
Korycarpus Zea.*
(*Diarrhena* Raf.)
Pleuropogon R. Brown.*
Uniola Linn.*
Distichlis Raf.*
Briza Linn.*
Dactylis Linn.*
Cynosurus Linn.*
Lamarckia Moench.*
Poa Linn.*
Colpodium Trin.
Dupontia R. Br.
Scolochloa Link.
Graphephorum Desv.*
Panicularia Fabr.*
(*Glyceria* R. Br.)
Puccinellia Parl.*
Festuca Linn.*
Bromus Linn.

Tribe XII.—*Hordeæ.*

Spikelets one- to many-flowered, usually hermaphrodite, sessile along the common rachis, forming a simple or compound spike;[1] glumes awned or awnless.

A small tribe of twenty genera and about one hundred and thirty species. It is an important division, however, for it includes rye, barley, and the many varieties of wheat. English and Italian Rye-grasses (*Lolium* species) are the chief meadow grasses of the tribe.

Nardus Linn.*
Lolium Linn.*
Lepturus R. Br.
Scribneria Hack.*
Agropyron Gaertn.*
Secale Linn.
Triticum Linn.
Hordeum Linn.*
Elymus Linn.*
Asperella Humb.*

Tribe XIII.—*Bambuseæ.*

Spikelets two- to many-flowered (rarely only one-flowered) in racemes or panicles; empty glumes at the base of the spikelet two to several: flowering glumes many-nerved, awnless, or very rarely short-awned; culms woody. at least near the base, and perennial; leaf blade usually with a short petiole articulated with the sheath from which it finally separates.

A comparatively small tribe of twenty-three genera and about one hundred and eighty-five species. The species are confined chiefly to the region within the Tropics. Many of them are of very great importance to the natives of the countries where they grow. Manufactured articles of bamboo, either of use or for ornament, are now a part of the commerce of the world. The bamboos are remarkable for their woody stems and often arborescent or tree-like habit of growth, some of the species attaining the height of 25 to 30 m. In parts of India they form extensive forests. One species in this tribe has leaves 2 to 5 m. long by 10 to 25 cm. wide; another, a Cuban species, has leaves 5 to 8 cm. long and as fine as a horse hair. Fleshy and edible, apple-like fruits are borne by some of the species.

---

[1] Strictly the spike is simple when the sessile spikelets are one-flowered. and compound when they are more than one-flowered.

Arundinaria Michx.

F. L. S.

AMERICAN GRASSES.

(ILLUSTRATED.)

BY F. LAMSON-SCRIBNER.

METRIC MEASUREMENTS AND THEIR ENGLISH EQUIVALENTS.

The metric system adopted in this Bulletin is now quite generally employed in botanical and other scientific publications. For those unfamiliar with this system the following expression of equivalents may be useful:

1 millimètre (1 mm.) = one twenty-fifth of an inch—exactly 0.0394 inche.

1 centimètre (1 cm.) = nearly one-half of an inch; 10 cm. = about 4 inches.

1 décimètre (1 dm.) = about 4 inches, or 3 dm. = one foot.

1 mètre (1 m.) = about 3 feet 3⅜ inches—exactly 39.37079 inches

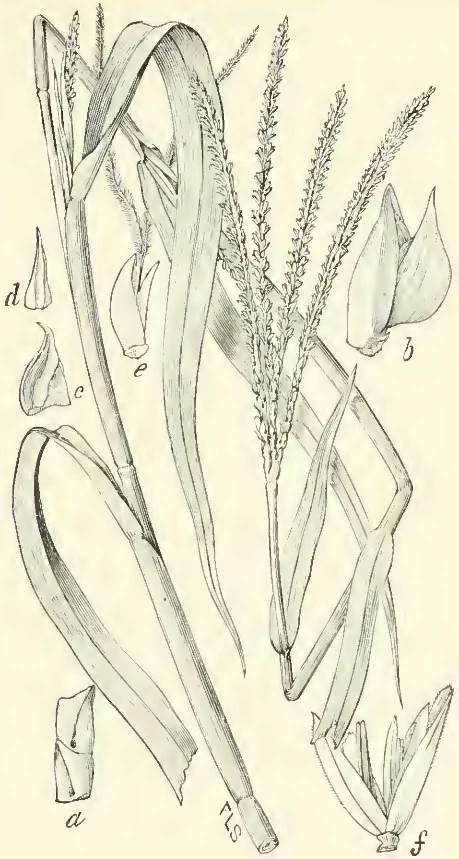


Fig. 1. **Tripsacum dactyloides** L. Gama-grass.—A stout, coarse, branching perennial 9 to 24 dm. high, with long and rather broad leaves and a spicate inflorescence, the spikes being 2 to 4 on the main stem and usually solitary on the branches.—Low meadows, moist thickets, ditches, etc.; Rhode Island to Florida, Kansas, and Texas. [Mexico.] April–October.

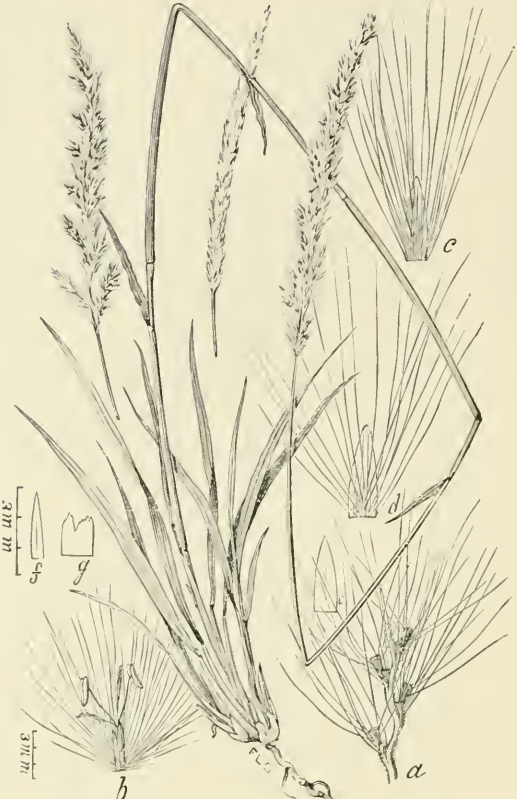


FIG. 2. **Imperata hookeri** Rupr. (*I. brevifolia* Vasey; *I. caudata* Scribn. not Trin.); Beal, Grasses N. Am., **2**: 22.—A stout, glabrous perennial 5 to 12 dm. high, with strong, creeping rootstocks, flat leaves, and elongated white-hairy, densely flowered panicles.—Western Texas, Nevada, New Mexico, Arizona, Southern California and southward.

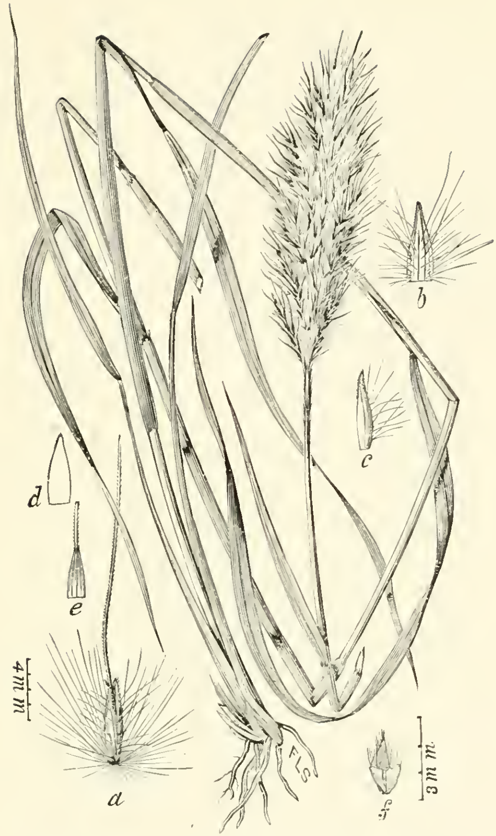


FIG. 3. **Erianthus compactus** Nash in Bull. Torr. Bot. Club, **22**: 419; Britton and Brown, Ill. Fl., **1**: 99. DENSELY FLOWERED PLUME-GRASS.—A stout, erect perennial 12 to 24 dm. high, with long, narrow leaves and densely flowered, oblong, brownish or reddish panicles 10 to 15 cm. long, the branches spreading in anthesis.—Meadows and swamps, mostly near the coast; New Jersey to Virginia and Tennessee. August–October.

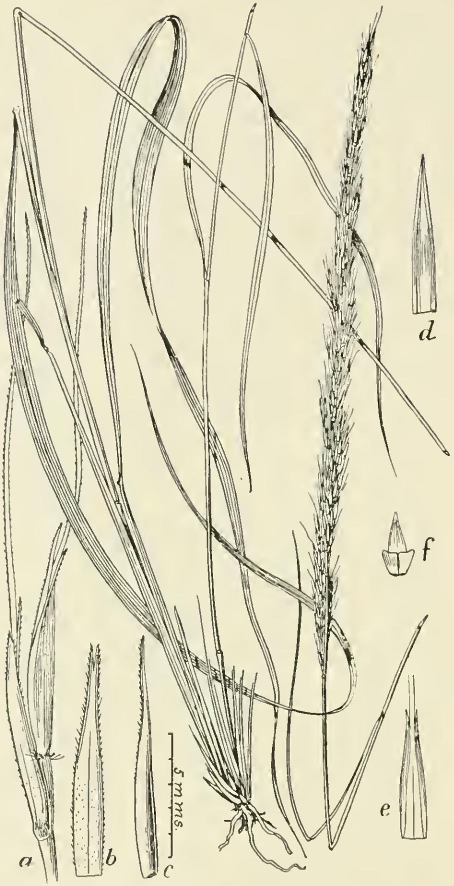


FIG. 4. **Erianthus strictus** Baldw.; Beal, Grasses N. Am., **2**: 29.—A stout, erect perennial 12 to 21 dm. high, with long, narrow, flat leaves and strict, bearded (with awns), but not hairy, panicles, 20 to 40 cm. long.—River bottoms, Tennessee and Georgia to Mississippi and Texas. September, October.

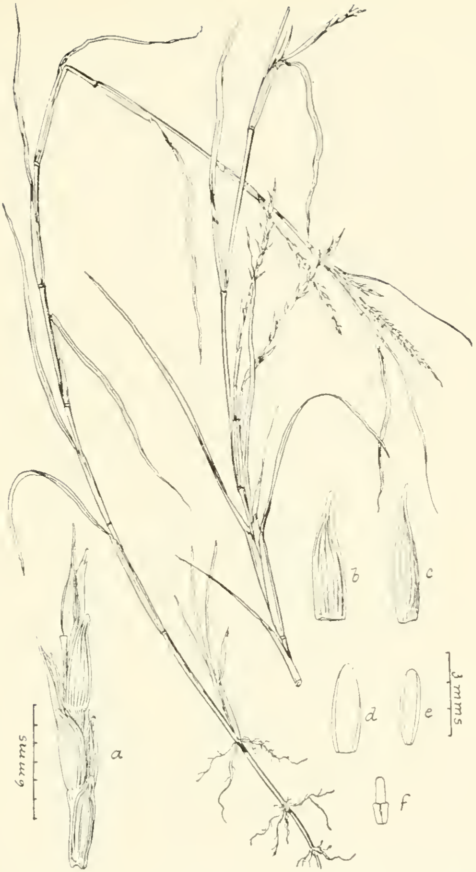


FIG. 5. **Manisuris compressa** (L. f.) Kuntze (*Rottboellia compressa* L. f.; *Hemarthria fasciculata* Kunth). MAT-GRASS.—A creeping perennial, with ascending and usually much branched, flattened culms 10 to 14 dm. high, and numerous slender spikes.—River banks, southwestern Texas. [Tropical and subtropical regions of both hemispheres.] September.

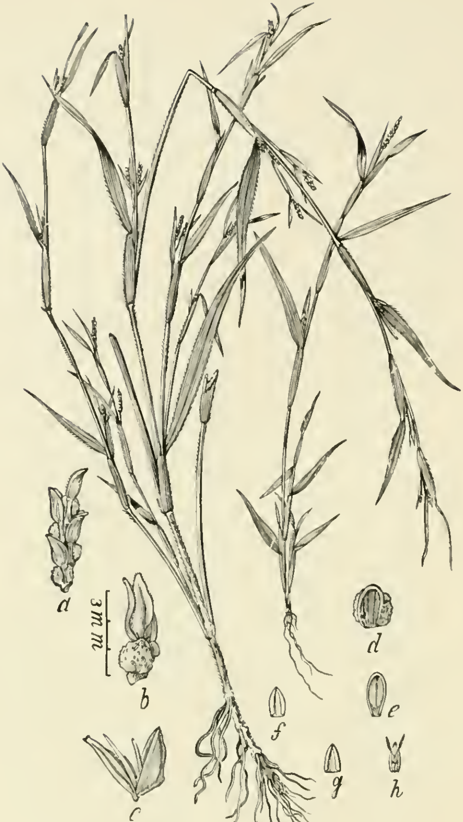


FIG. 6. **Hackelochloa granularis** (Sw.) Kuntze (*Manisuris granularis* Sw.; *Cenchrus granularis* Linn.); Beal, Grasses N. Am., **2**: 33. LIZARD-TAIL-GRASS.—A much-branched, leafy annual, 3 to 12 dm. high, with numerous slender spikes in irregular, leafy panicles.—A weed in all tropical countries, extending northward into the warmer parts of the Southern and Southwestern States.

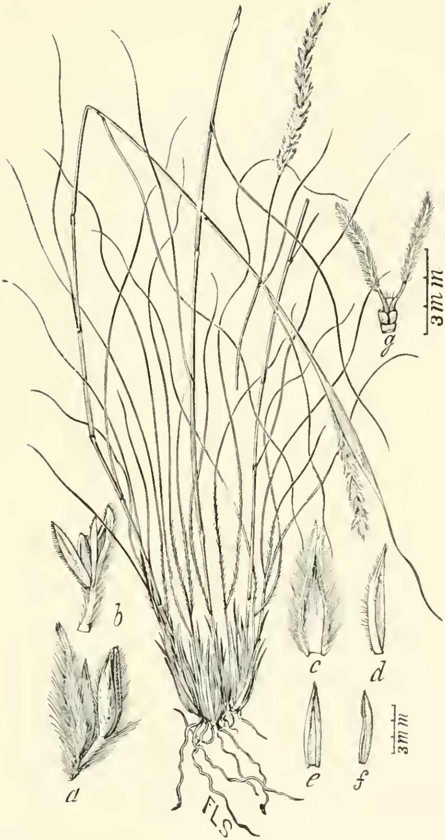


FIG. 7. **Elionurus barbiculmis** Hack.; Beal, Grasses N. Am., **2**: 37.—A slender, erect perennial 4 to 7 dm. high, with very narrow, filiform, hairy leaves and silky-villous, solitary spikes terminal on the culm or its branches.—Rocky hills and canyons, western Texas to Arizona. [Northern Mexico.] June–September.

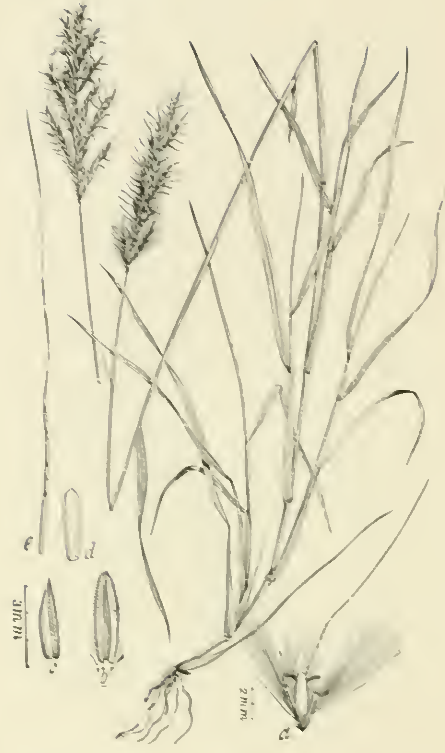


FIG. 8. **Andropogon saccharoides torreyanus** (Steud.) Hack.; Britton and Brown, **1**: 103 (*Andropogon torreyanus* Steud.). TORREY'S SILVER BEARD-GRASS.—A variable native perennial 3 to 9 dm. high, with rather long, usually glaucous, flat leaves, and narrow silvery-bearded panicles.—Dry prairies and mesas, Kansas to Texas, New Mexico, and Nevada. [Mexico.] July–October.

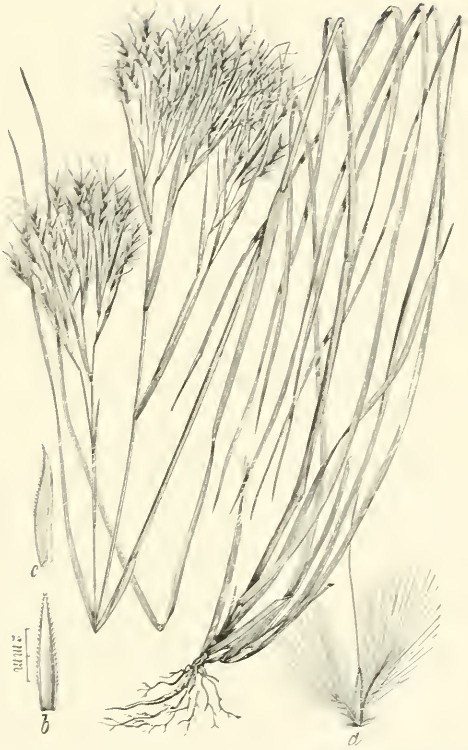


Fig. 9. **Andropogon glomeratus** (Walt.) B. S. P. (*Andropogon macrourus* Michx.). Brook-grass.—A stout perennial 6 to 12 dm. high, with dense, more or less elongated panicles, the branches usually very much crowded.—Low grounds and marshes, southern New York to Florida, southern California and Nevada. [Mexico, Lower California, Cuba, and Jamaica.] September–January.

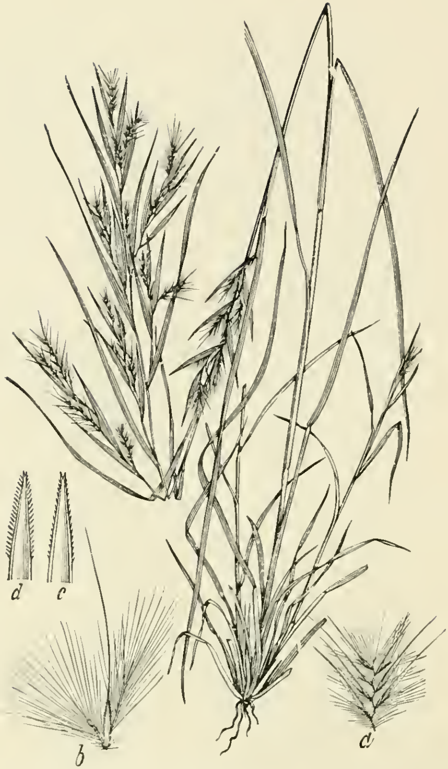


FIG. 10. **Andropogon virginicus** L. BROOM SEDGE.—A rigidly erect perennial 6 to 12 dm. high, with the culms flattened near the base, and narrow, elongated, and loosely branched panicles of silky-bearded racemes, for the most part partially inclosed within smooth, spathe-like bracts.—Old fields and borders of woods, usually in dry soil, Massachusetts to Florida and Texas. [Cuba.] August–October.

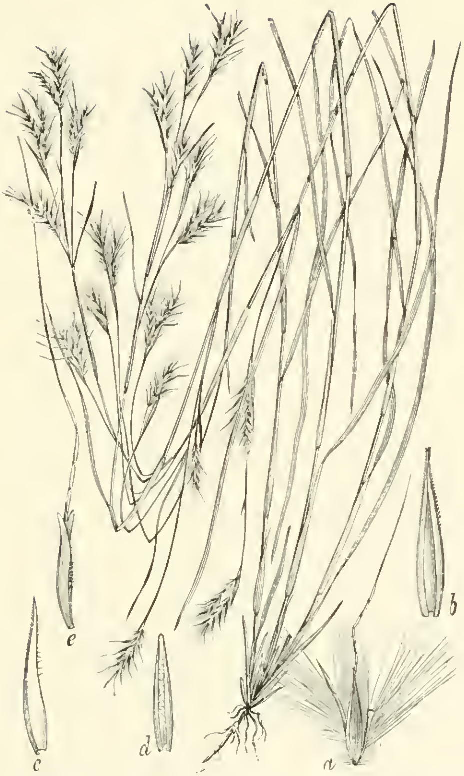


FIG. 11. **Andropogon argyræus** Schultes. SILVER-BEARD OR SILVERY BEARD-GRASS.—A rather slender native grass 6 to 9 dm. high, with narrow leaves and silky-bearded racemes, which are in pairs, terminal on the culm or its branches.—In dry, sandy soil in open woods and along thicket borders from Delaware to Missouri and southward to the Gulf. August–October.

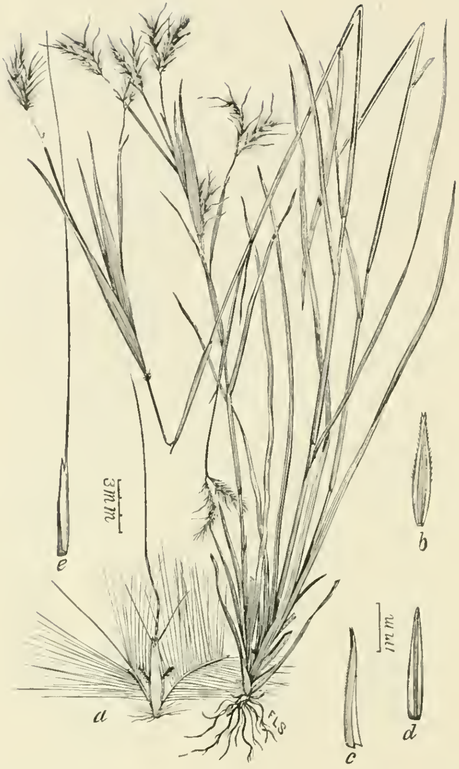


Fig. 12. **Andropogon elliottii** Chapm. Elliott's Broom Sedge.—A slender, upright perennial 6 to 9 dm. high, the plumose racemes in pairs or ternate and subtended by conspicuously inflated upper leaf sheaths.—Dry upland woods or low pine barrens, Delaware and Pennsylvania to central Florida and Texas. July–October.

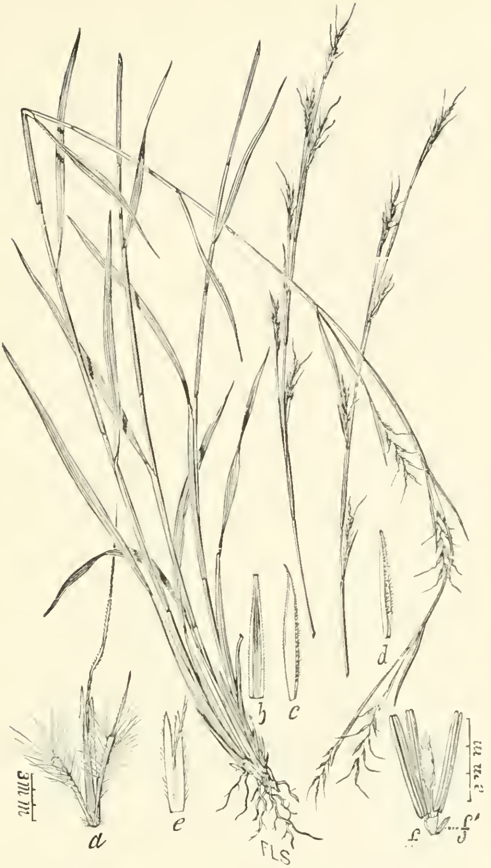


FIG. 13. **Andropogon scoparius** Michx. LITTLE BLUE-STEM.—A rather slender perennial 3 to 9 dm. high, the solitary racemes terminating the culms and branches.—Dry fields and borders of woods, New Brunswick westward to the Saskatchewan, southward to Florida, Texas, and southern California. [Mexico.] July–October.

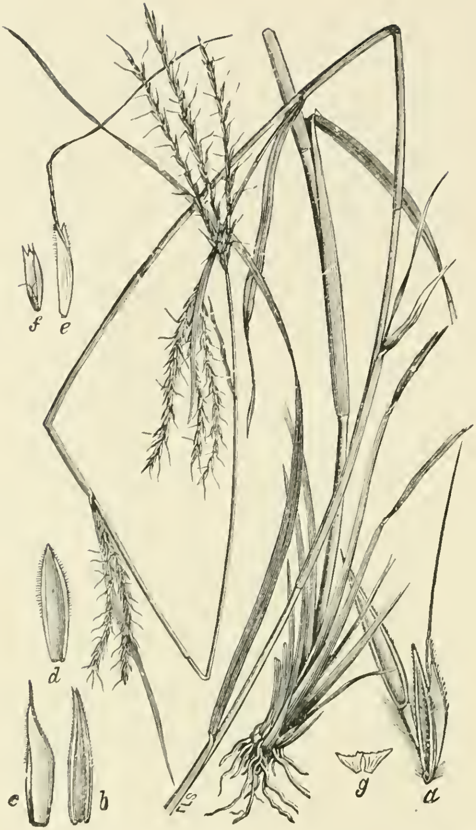


Fig. 14. **Andropogon provincialis** Lam. (*A. furcatus* Muhl.) Big Blue-stem.—A stout perennial 6 to 16 dm. high, with long leaves, and rather thick spikes 3 to 10 cm. long.—From the Rocky Mountains eastward to the Atlantic and southward to the Gulf of Mexico. August–October. Especially abundant and valued for hay in the prairie regions.

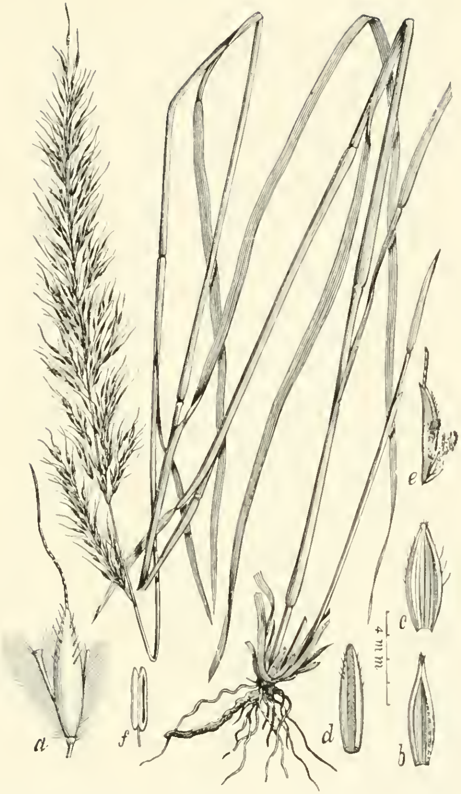


FIG. 15. **Andropogon nutans avenaceus** (Michx.) Hack. INDIAN GRASS.—A stout perennial 12 to 18 dm. high, with long leaf blades, and long, rather dense, usually somewhat nodding brownish panicles.—Dry fields, glades, and borders of woods, Ontario to South Dakota and Manitoba, south to Florida, Texas, and Arizona. [Mexico, Central and South America.] July-October.

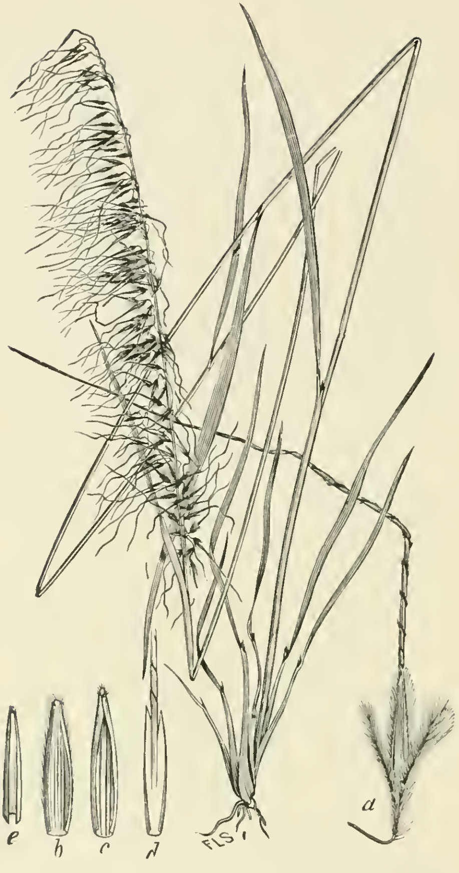


FIG. 16. **Andropogon unilateralis** Hack.; Beal, Grasses N. Am., **2**: 60. (*Andropogon secundus* Ell. not Willd.) BANNER SORGHUM.—A rather stout perennial, 6 to 12 dm. high, with narrow, one-sided, many-flowered panicles 18 to 25 cm. long, and long-awned spikelets.—Low pine lands, South Carolina, Florida. June–October.

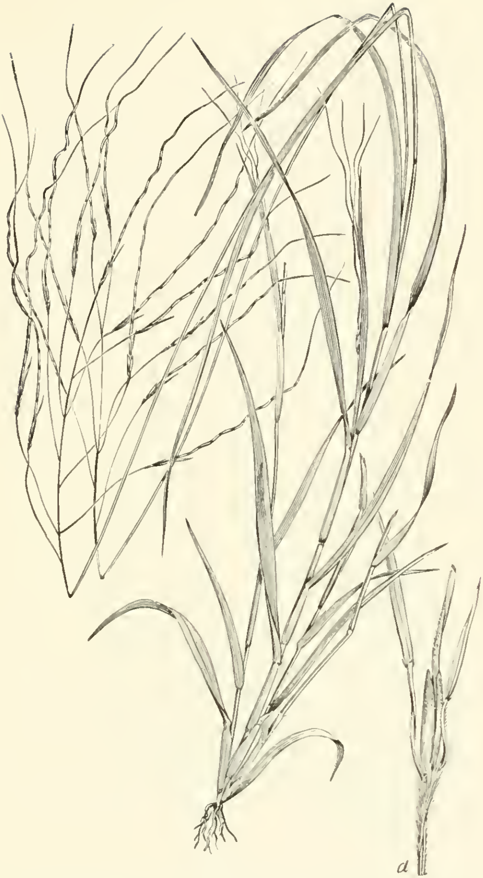


Fig. 17. **Andropogon pauciflorus** (Chapm.) Hack.; Beal, Grasses N. Am., **2**: 61. (*Sorghum pauciflorum* Chapm.). Few-flowered Sorghum.—A rather stout, branching, leafy annual, 6 to 12 dm. high, with few-flowered panicles and long-awned spikelets.—Dry fields, Florida. [Cuba.] October.

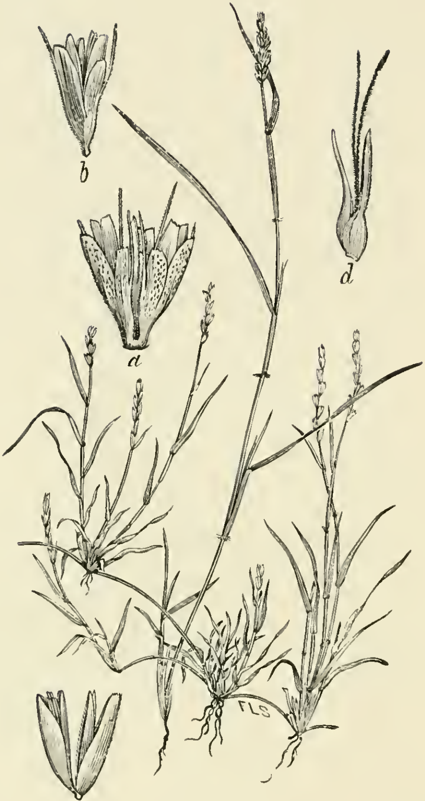


Fig. 18. **Hilaria cenchroides** HBK.; Beal, Grasses N. Am., **2** : 68. Creeping Mesquite.—A slender, creeping perennial, with upright leafy branches 1 to 3 dm. high.—Dry prairies, mesas, and foothills, Texas to Arizona. [Mexico.] April–October. One of the most valuable of the native grasses for grazing.

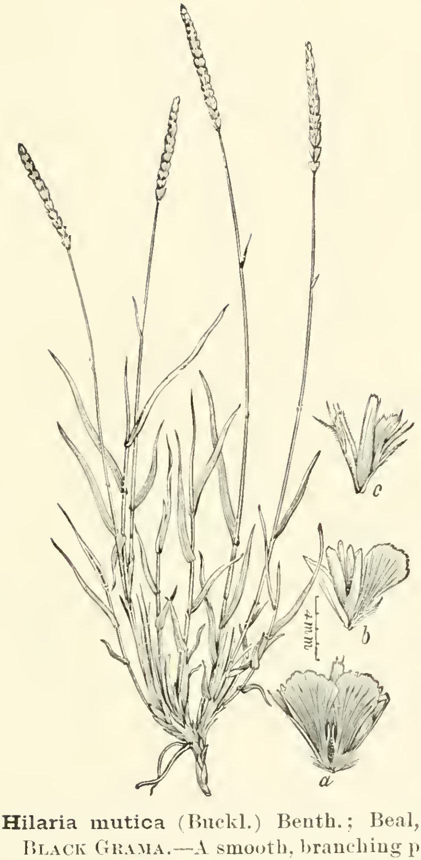


FIG. 19. **Hilaria mutica** (Buckl.) Benth.; Beal, Grasses N. Am., **2** : 69. BLACK GRAMA.—A smooth, branching perennial 4 to 6 dm. high, with densely flowered, usually straw-colored spikes about 5 cm. long.—Dry mesas, Texas to southern California. May–September. Valued for forage, especially for grazing.

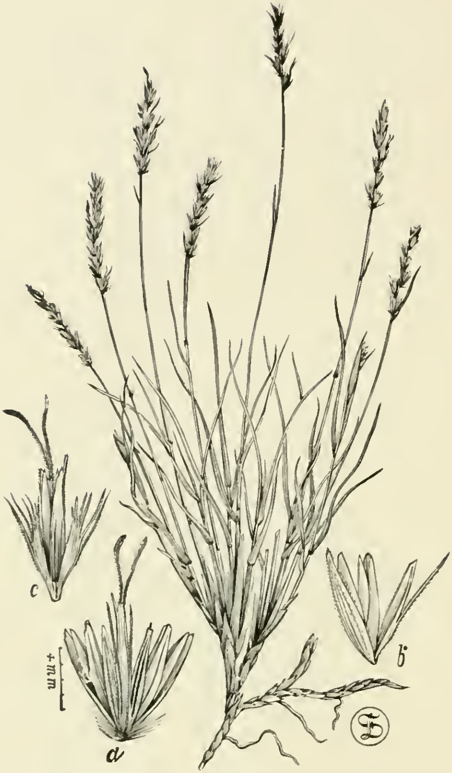


FIG. 20. **Hilaria jamesii** (Torr.) Benth.; Beal, Grasses N. Am., **2**: 70. BLACK BUNCH-GRASS.—A rather coarse, branching perennial 3 to 5 dm. high, with erect, often purplish spikes 5 to 8 cm. long.—Mesas and table-lands of southern Colorado and Utah to New Mexico and southern California. March–July. A valuable hay or pasture grass.

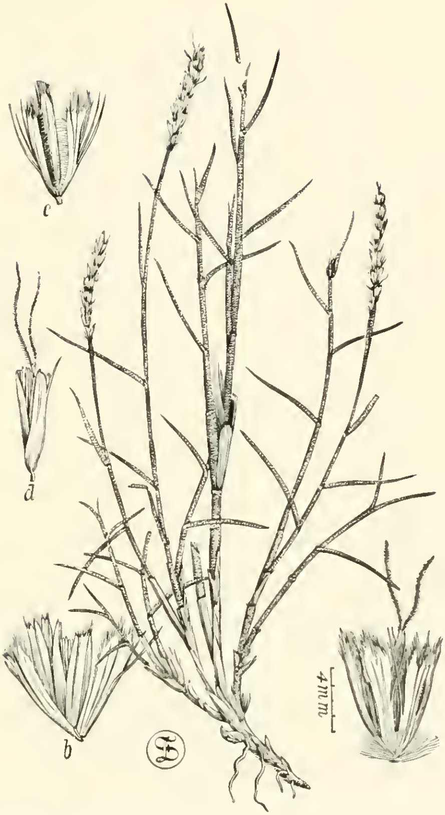


FIG. 21. **Hilaria rigida** (Thurb.) Vasey; Beal, Grasses N. Am., **2**: 68. (*Pleuraphis rigida* Thurb.) GALLETA.—A coarse, much-branched, and woody perennial 6 dm. high, growing in great clumps, somewhat resembling dwarf bamboos in habit —Deserts, southern Utah to Arizona and southern California. [Lower California.] May-July.

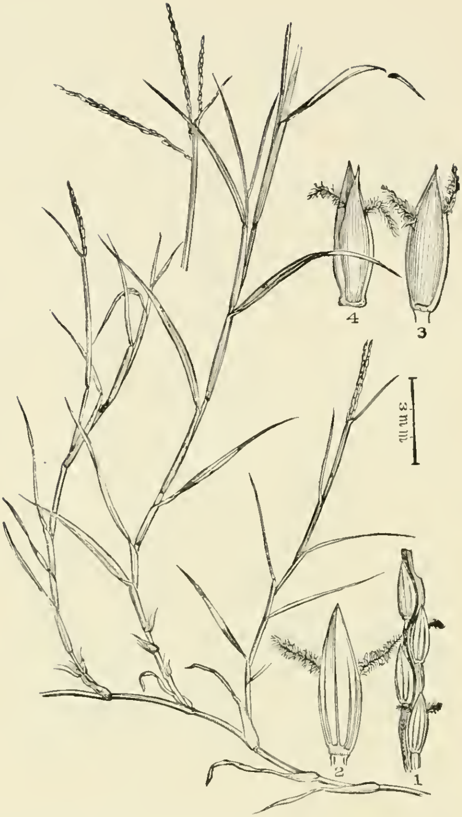


FIG. 22. **Reimaria oligostachya** Munro in Benth. Journ. Linn. Soc.; Beal, Grasses N. Am., **2**: 80. CREEPING REIMARIA.—An extensively creeping perennial, with flat leaves and upright flowering branches 2 to 4 dm. high, bearing two to four spikes 4 to 7 cm. long.—Ditches and brackish river shores, often in water, eastern Florida. [Cuba.] April-September.

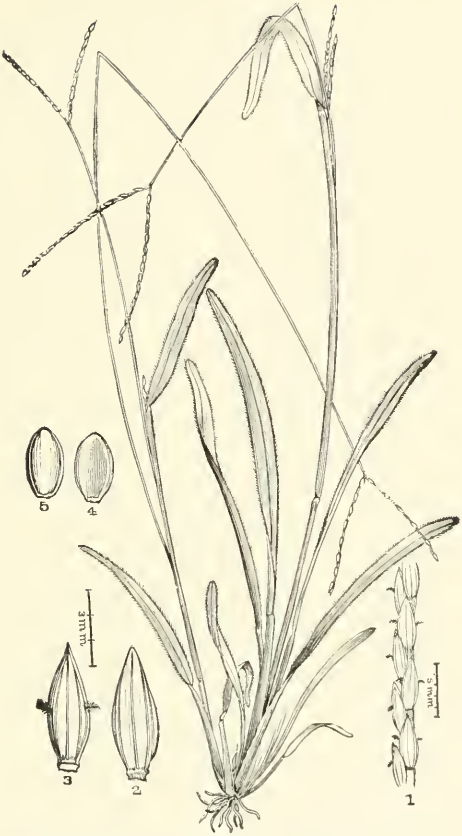


Fig. 23. **Paspalum paspaloides** (Michx.) Scribn. (*P. elliottii* S. Wats.; *P. digitaria* Poir.). Elliott's Paspalum.—A soft perennial grass 5 to 8 dm. high, geniculate and more or less creeping at the base, with rather broad, flat leaves and slender spikes, which are usually in pairs.—Borders of ponds and ditches and in low pine barrens near the coast, Maryland to Texas. April–August.

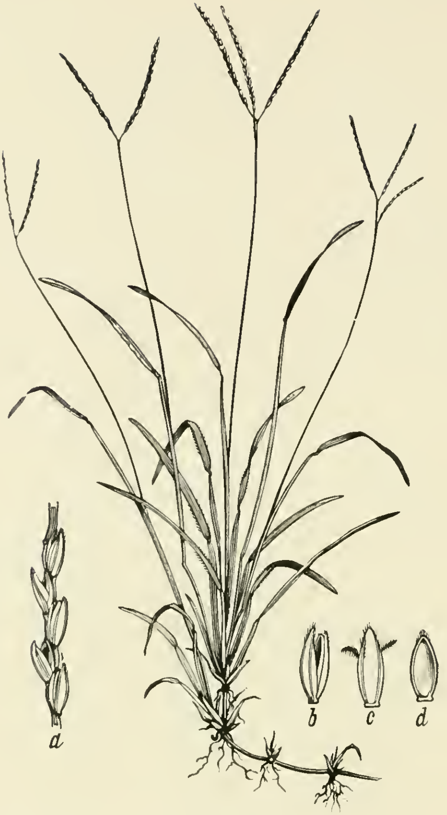


Fig. 24. **Paspalum compressum** (Sw.) Nees. (*P. platycaule* Poir.). Louisiana or Carpet-grass.—A slender, erect, or more frequently prostrate and extensively creeping perennial, rooting at the nodes and sending up numerous leafy or flower-bearing branches 1.5 to 6 dm. high, with 2 to 6 subdigitate slender spikes and small, acutish spikelets.—Low ground and moist pastures, abundant near the coast from Virginia to Texas. [Mexico, Central and South America, and West Indies.] April–October. A valuable pasture grass.

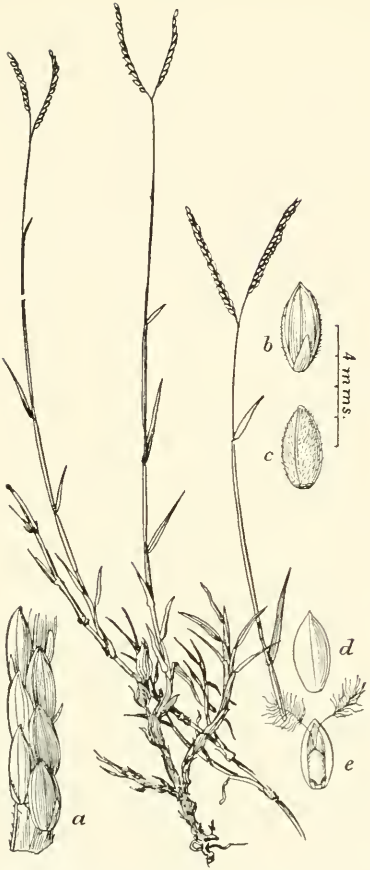


FIG. 25. **Paspalum distichum** L. KNOT-GRASS.—A low, creeping, somewhat succulent perennial, with flat leaves and two spikes at the apex of the upright flower-bearing branches, which are 1 to 3 dm. high. Habit of growth resembling Bermuda-grass.—Ditches and muddy or sandy shores, Virginia and Missouri to Florida, Texas, and southern California; northward on the Pacific Coast to Oregon. [Widely distributed in tropical and subtropical regions.] April–October.

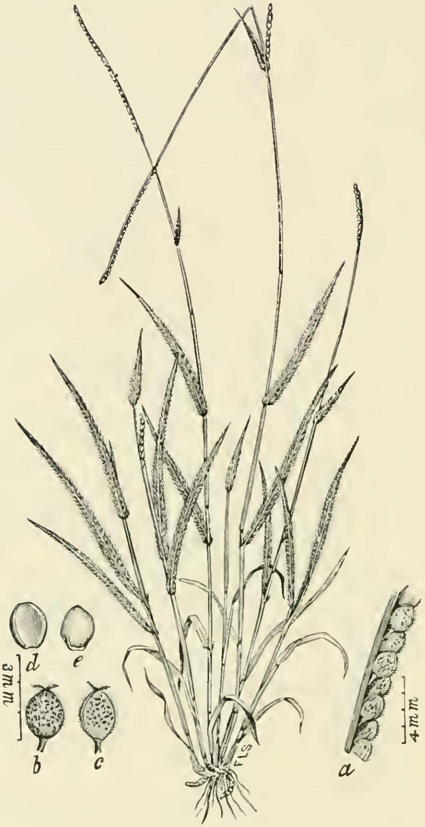


FIG. 26. **Paspalum setaceum** Michx. SLENDER PASPALUM.—A slender, erect, or ascending native perennial, usually about 6 dm. high, with flat, often hairy leaves, and slender, small-flowered spikes.—Dry, sandy fields and pine barrens, Massachusetts to northeastern Nebraska, Texas and Florida. April–October.

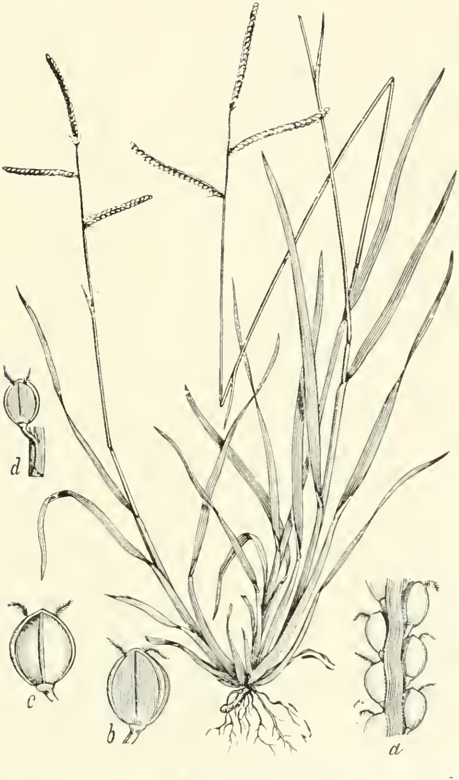


FIG. 27. **Paspalum læve** Michx. SMOOTH PASPALUM.—Perennial, with ascending culms, often geniculate at base, 3 to 9 dm. high, with smooth or pilose leaf sheaths and blades, and 3 to 7 spreading spikes 5 to 10 cm. long. Low, often wet, ground, Rhode Island to Florida, eastern Texas and Missouri. June–October.

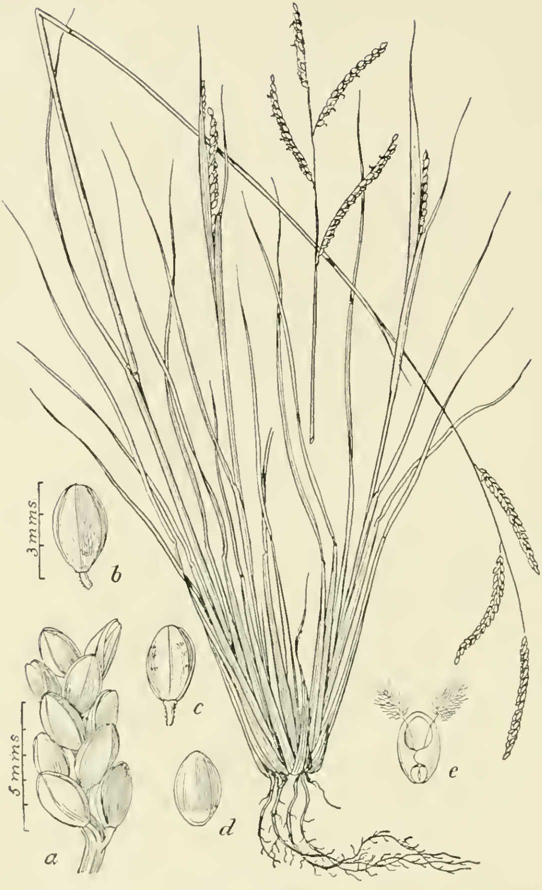


FIG. 28. **Paspalum plicatulum** Michx.; Beal, Grasses N. Am., **2**: 90. WRINKLE-FLOWERED PASPALUM.—An erect or ascending perennial 3 to 6 dm. high, with smooth or flat leaves and 5 to 7 rather densely flowered racemes. The second glume is usually plicate or wrinkled.—Dry fields and open pine woods, Georgia and Florida to Texas. [Mexico, Central and South America, and West Indies.] April–October.

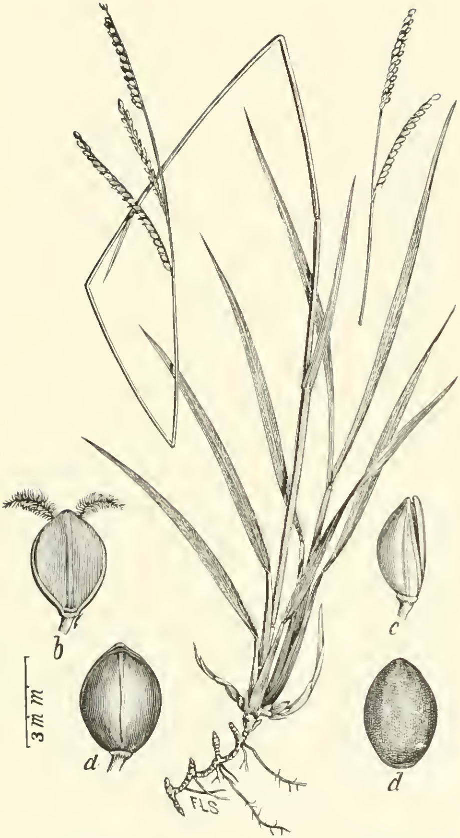


Fig. 29. **Paspalum difforme** Le Conte; Vasey Proc. Acad. Nat. Sci. Phila. 1886, 286.—A stout perennial, from creeping rootstocks. Allied to *P. floridanum*, but less robust, with shorter leaves and spikes.—Dry pine barrens near the coast, North Carolina to Florida and westward to Texas. June-October.

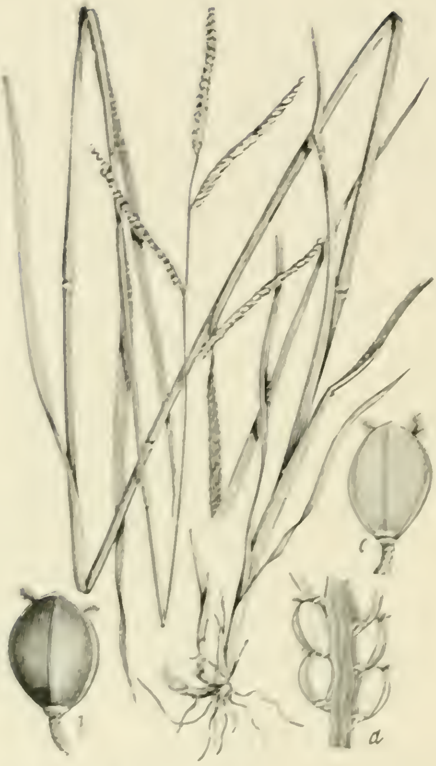


FIG. [illegible]. **Paspalum floridanum** Michx. FLORIDA PASPALUM.—A stout, erect grass 9 to 12 dm. high, often glaucous, with long leaves, smooth or villous sheaths and blades, and large spikelets. Dry or moist low ground, Delaware to Florida, Texas, Kentucky, and Indian Territory. June–October.

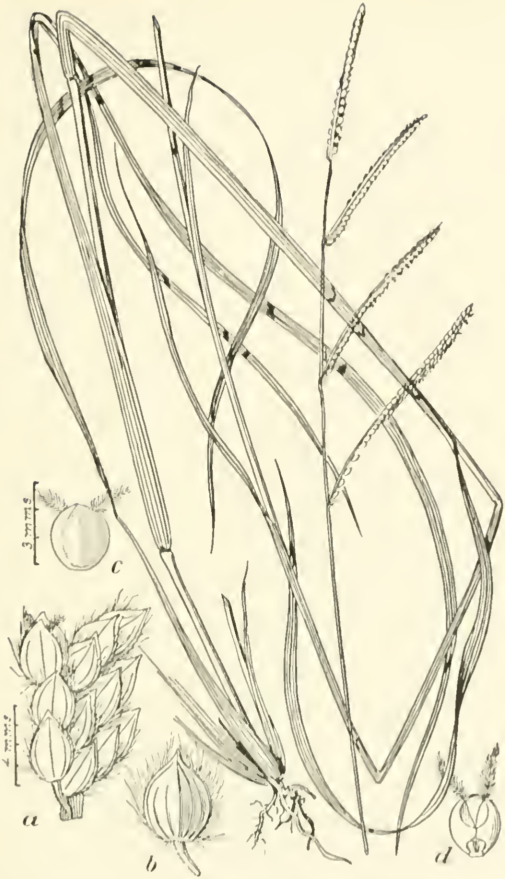


Fig. 31. **Paspalum dilatatum** Poir. (*P. ovatum* Nees). Large Water-grass.—A somewhat coarse, leafy perennial, growing in clumps 6 to 15 dm. high, bearing 2 to 10 more or less spreading racemes of hairy spikelets. In meadows, waste ground, and along ditches, southeastern Virginia to Florida, west to Texas; apparently naturalized. [South America.] July-October.

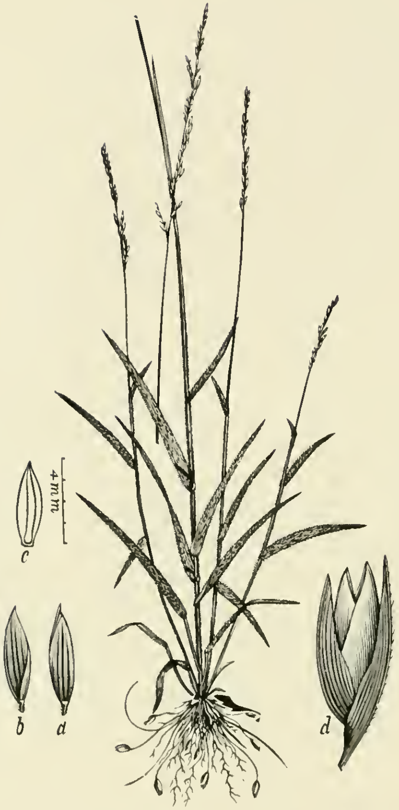


FIG. 32. **Amphicarpon purshii** Kunth. PURSH'S AMPHICARPON.—An erect, tufted perennial 3 to 12 dm. high, with hispid sheaths and leaves and contracted panicles. Fertile spikelets solitary and subterranean.—Pine barrens and cranberry bogs near the coast, New Jersey. August, September.

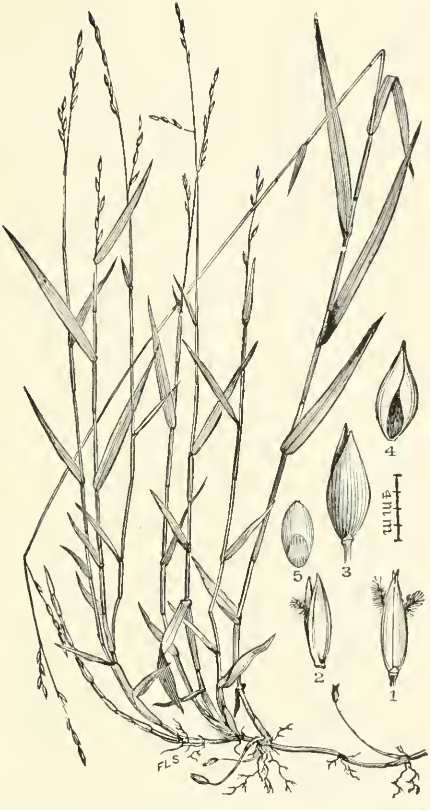


FIG. 33. **Amphicarpon floridanum** Chapm.; Beal, Grasses N. Am., **2**: 100. FLORIDA AMPHICARPON.—A pale-green, smooth perennial 3 to 9 dm. high, from creeping rootstocks, with flat leaves and narrow panicles 10 to 20 cm. long. Fertile spikelets on subterranean branches.—Moist pine barrens and sandy shores, Florida (throughout the State). July–September.

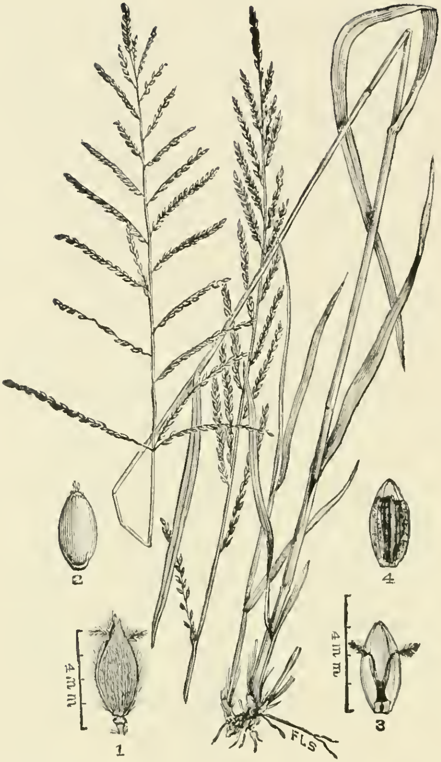


FIG. 34. **Eriochloa mollis** (Michx.) Kunth. (*Panicum molle* Michx.), Beal, Grasses N. Am., **2**: 102. SOFT WOOL-GRASS.—A perennial 10 to 20 dm. high, with long, flat leaves and open panicles of numerous, more or less spreading racemes 3 to 6 cm. long.—Brackish marshes and shores, South Carolina to Florida. April-September.

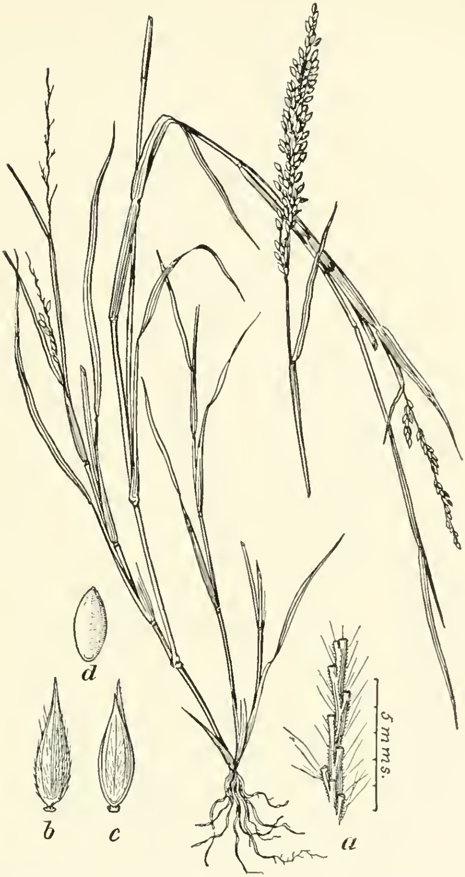


FIG. 35. **Eriochloa punctata** (L.) W. Hamilt. EVERLASTING-GRASS.—A rapid-growing, smooth and somewhat succulent perennial, with more or less branching culms 6 to 12 dm. high, flat leaves and narrow panicles 5 to 10 cm. long.—Low, rich land, moist soil, prairies, etc., Kansas to Texas and Arizona. [Tropical America, Asia, and Australia.] June–September.

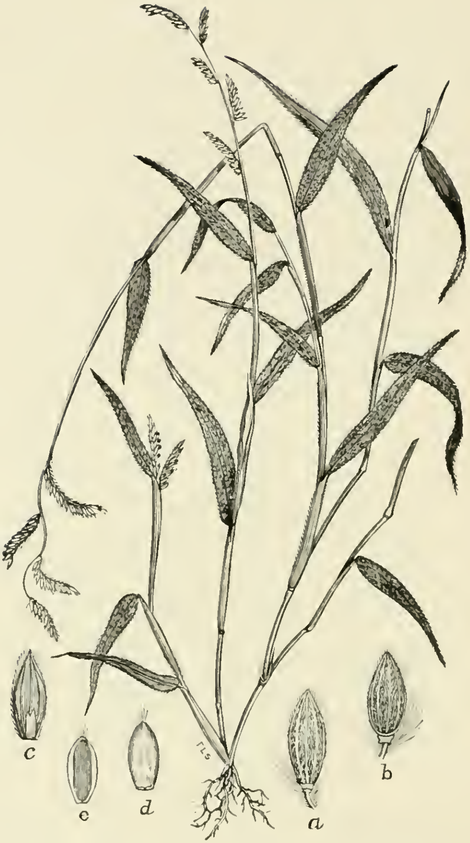


FIG. 36. **Eriochloa lemmoni** Vasey & Scribn.; Beal, Grasses N. Am., **2** : 101. LEMMON'S WOOL-GRASS.—A softly pubescent perennial 3 to 6 dm. high, with rather broad leaves and a short panicle composed of about 6 spreading spikes 2 to 3 cm. long.—Arizona. [Northern Mexico.] August-November.

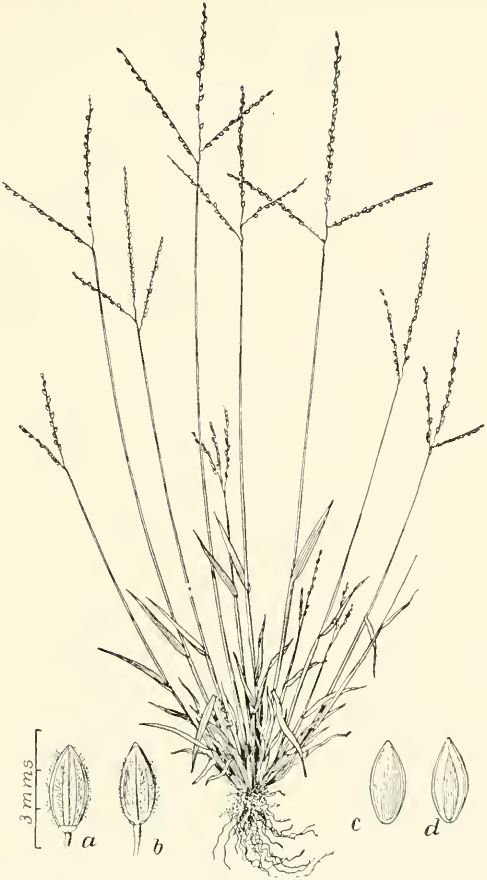


FIG. 37. **Panicum lineare** Krock (*Panicum glabrum* Gaud.; *Syntherisma linearis* Nash). SMOOTH CRAB-GRASS.—A slender, glabrous annual 1.5 to 3.5 dm. high, with culms which are much branched below, flat leaves, and 2 to 6 slender diverging spikes.—Naturalized in waste and cultivated land; Nova Scotia to Ontario and South Dakota, south to Florida and Texas. [Europe.] August–October.

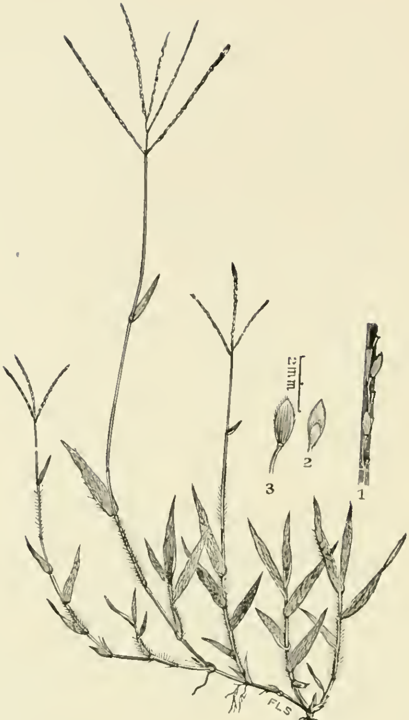


FIG. 38. **Panicum serotinum** (Walt.) Trin. (*Syntherisma serotina* Walt.; *Digitaria serotina* Mx.). LITTLE CRAB-GRASS.—An extensively creeping annual or biennial, with flat, hairy leaves, and slender spikes digitate at the apex of the ascending culms, which are 1 to 3 dm. high.—Low, sandy ground, roadsides, pastures, and cultivated fields near the coast, Delaware to Mississippi; on ballast at Philadelphia. June–August.

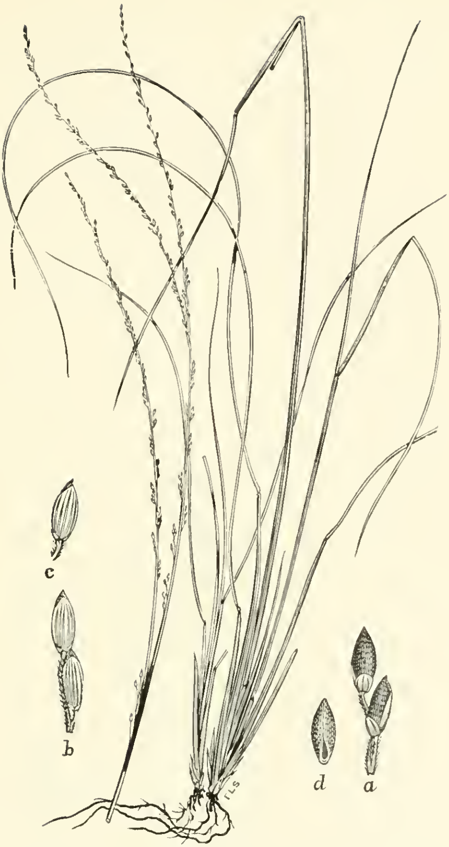


Fig. 39. **Panicum gracillimum** Scribn.; Bull. Torr. Bot. Club, **23**: 146. Slender Panicum.—A slender perennial 3 to 9 dm. high, with very narrow, elongated leaves and small, glabrous spikelets, racemose along the main axis and its branches, which are approximate near the apex of the culm. Outer glumes glabrous.—High pine lands, Lake County, Florida. (1192, Nash.) July.

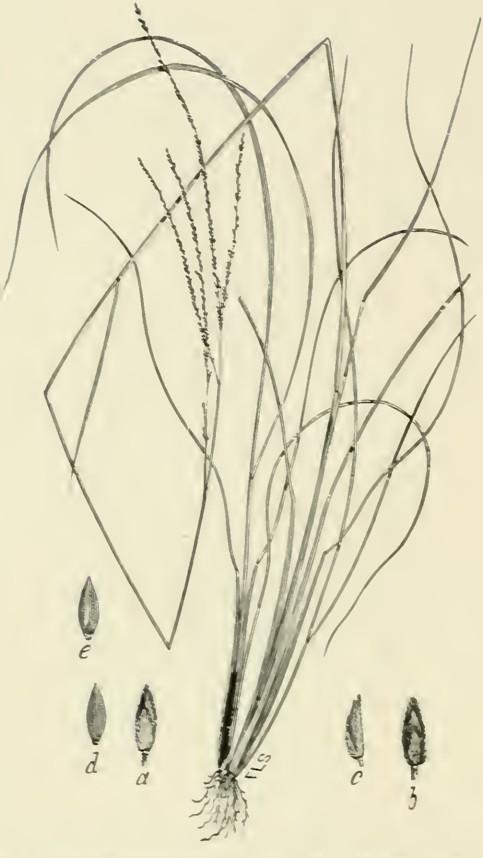


FIG. 40. **Panicum phæothrix** Trin. Sp. Gram. Icon. 91. SILVERY PANIC-GRASS.—A slender perennial about 9 dm. high, with long, narrow leaves and very slender, rather loosely flowered racemes 10 to 20 cm. long, approximate near the apex of the culm. Outer glumes densely hairy.—High pine lands, Florida. (Nash, 1155.) [Brazil.] July.

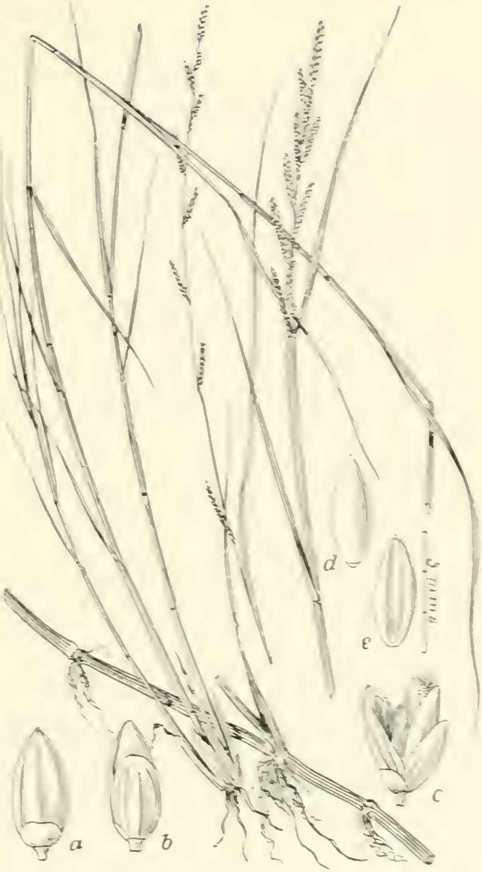


FIG. 41. **Panicum paspaloides** Pers.: Beal. Grasses N. Am., 2: 114. SOUTHERN WATER-GRASS.—A rather stout, smooth, and more or less branching perennial 6 to 9 dm. high, often creeping at the base, with long, flat leaves, and ten to twenty alternate, one-sided spikes 2 to 3 cm. long.—About ponds and in standing water, southern Florida; Texas. [In tropical countries of both hemispheres.] May–July.

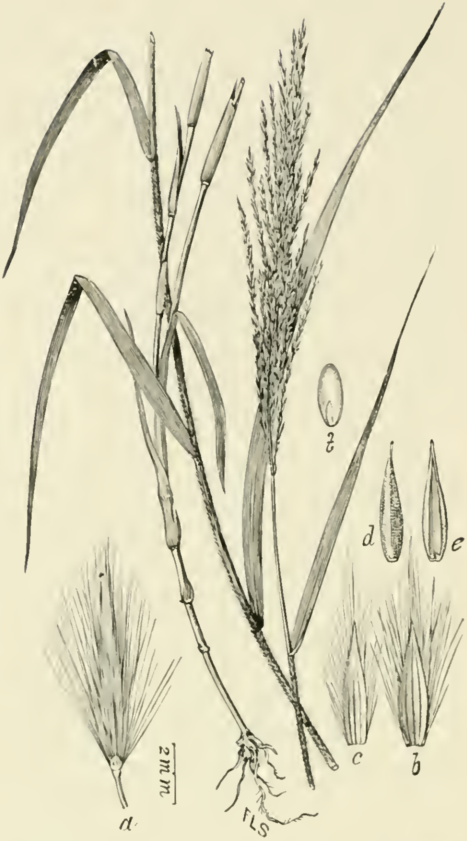


FIG. 42. **Panicum lanatum** Rottb. (*P. leucophæum* HBK.); Beal, Grasses N. Am., **2**: 111. COTTON-GRASS.—A rather stout, more or less branching leafy perennial 6 to 12 dm. high, with narrow, soft-hairy panicles.—Cultivated ground, river banks, and coral soil on keys, central and southern Florida; on ballast at Mobile, Ala. [Widely distributed in tropical America; Australia; Africa.] May-October.

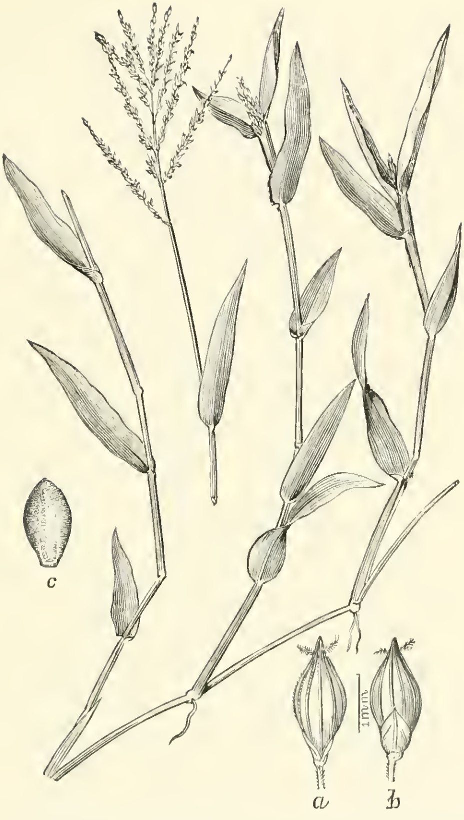


FIG. 43. **Panicum grossarium** L.; Beal, Grasses N. Am., **2**: 116. JAMAICA CRAB-GRASS.—Apparently an annual, with much-branched, ascending culms 3 to 6 dm. long, broad, lanceolate leaves and spreading panicles of a few simple racemes of glabrous spikelets.—Ballast ground, Philadelphia. Adventive. [West Indies.] September. Cultivated in grass garden, and apparently valuable.

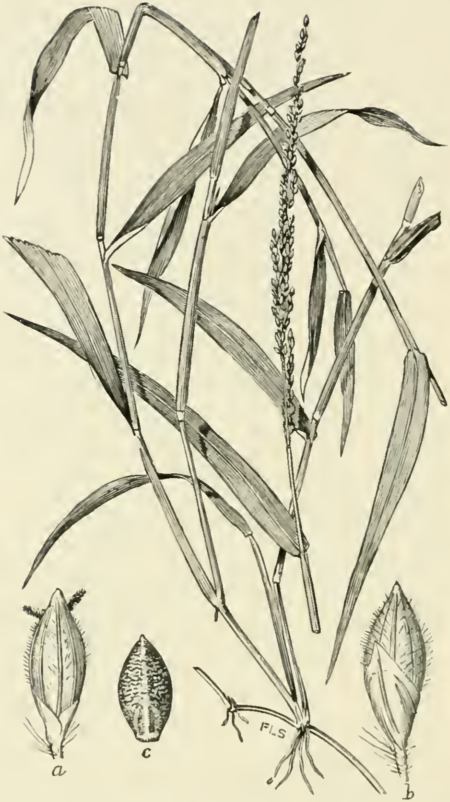


FIG. 41. **Panicum texanum** Buckl.; Beal, Grasses N. Am., **2**: 117. TEXAS MILLET.—A branching, leafy annual 6 to 12 dm. high, with flat leaves and narrow panicles 1.5 to 2 dm. long.—Texas. September.

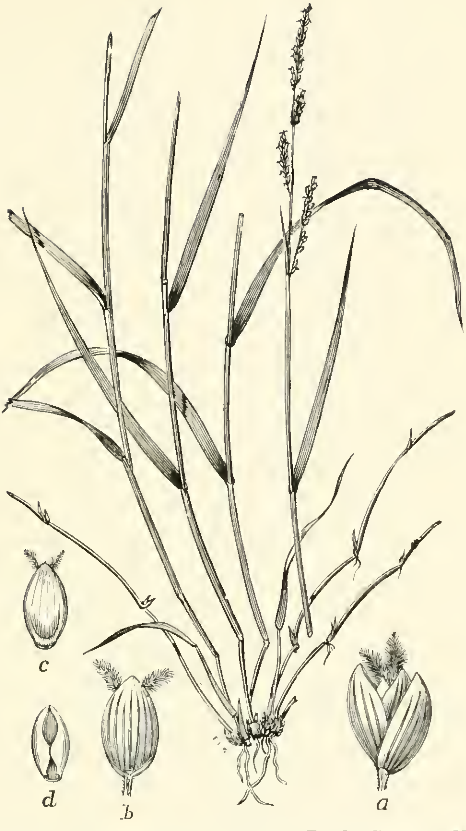


FIG. 45. **Panicum obtusum** HBK.; Beal, Grasses N. Am., **2**: 115. VINE MESQUITE-GRASS.—Stoloniferous perennial, the runners often 24 to 30 dm. long; the upright flowering branches 3 to 6 dm. high. Panicle of three to five erect racemes, bearing rather large obtuse spikelets.—Irrigated lands, low valleys, chiefly in the shade of trees and shrubs, Kansas and Colorado to Texas, New Mexico, Arizona, and southward. June-September.

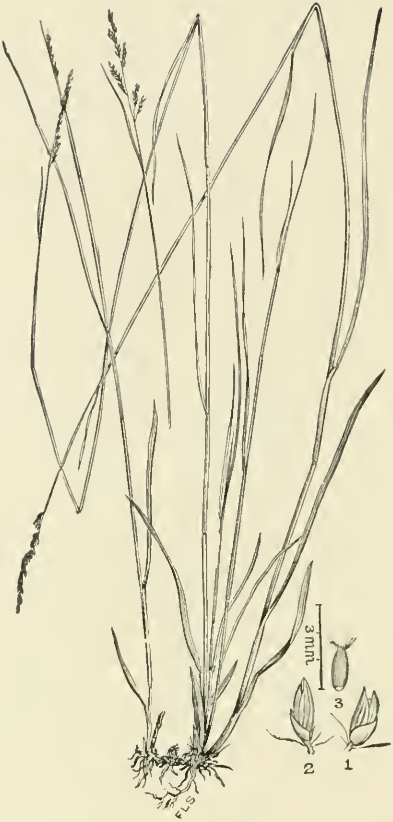


Fig. 46. **Panicum stenodes** Griseb. (*P. anceps strictum* Chapm.); Beal, Grasses N. Am., **2**: 126. Small-jointed Panic-grass.—A slender, erect, glabrous perennial, with wiry stems 5 to 8 dm. high, rigid, involute leaves, and narrow, simple panicles 4 to 8 cm. long.—Moist, sandy pine barrens near the coast, Florida to Texas. [Cuba and San Domingo.] July–October.

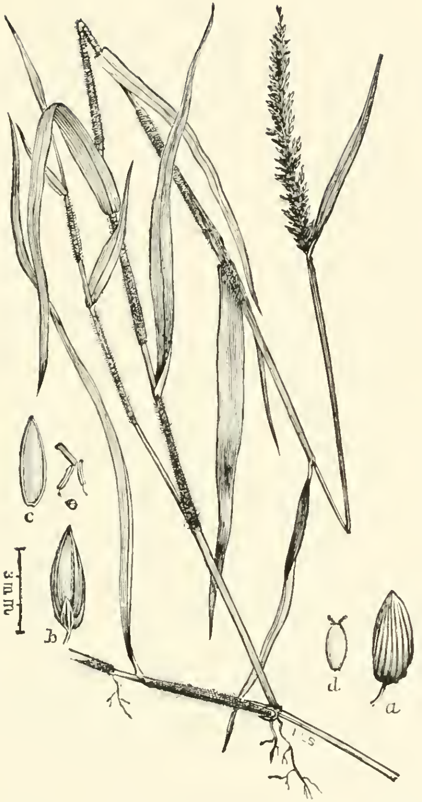


FIG. 47. **Panicum gibbum** Ell. GIBBOUS PANIC-GRASS.—A stoloniferous, branching perennial 3 to 9 dm. high, with narrowly lanceolate, flat leaves, and densely flowered spike-like panicles 10 to 15 cm. long.—Low, wet grounds, Virginia to Florida, Tennessee, Louisiana, and Indian Territory. [Cuba.] June–October.

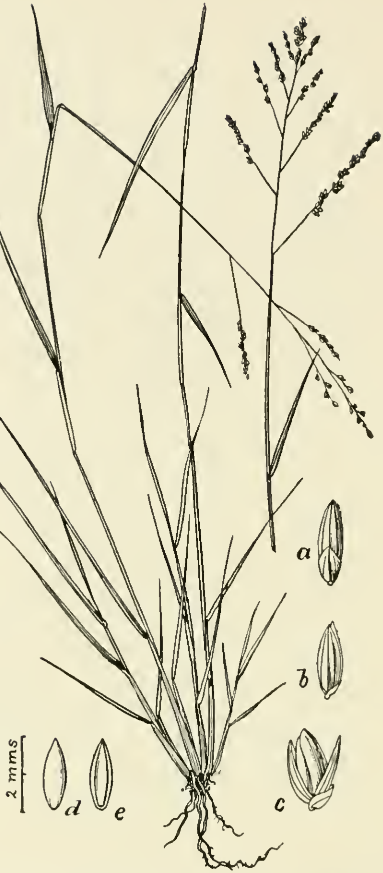


FIG. 48. **Panicum melicarium** Michx. (*P. hians* Ell.); Beal, Grasses N. Am., **2** : 127.—A smooth, slender, usually erect perennial 2 to 5 dm. high, with narrow, flat leaves and simple, open panicles 6 to 15 cm. long.—Moist pine barrens and marshes. North Carolina to Florida, Missouri, Indian Territory, and Texas. March–October.

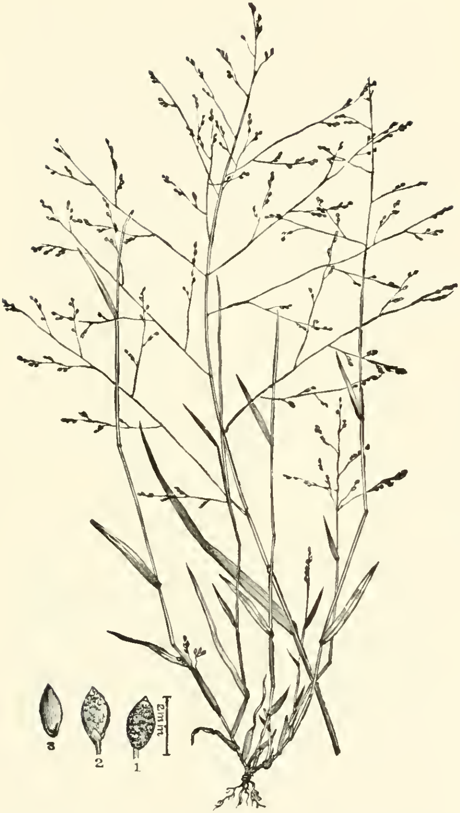


Fig. 49. **Panicum verrucosum** Muhl. Warty Panic-grass.—A slender, branching perennial, with flat leaves and few-flowered spreading panicles 7.5 to 20 cm. long.—Low, rich woodlands, mostly near the coast, New England to Florida, west to Tennessee and Louisiana. May–October.

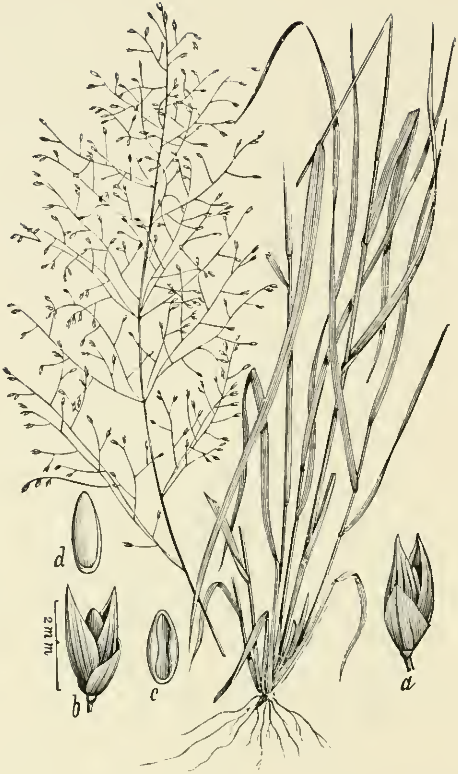


FIG. 50. **Panicum filipes** Scribn. in Heller, Contrib. Herb. Franklin & Marshall Coll., **1** : 13 (1895).—A slender, more or less branching and leafy, glaucous annual (?) 3 to 7 dm. high, with rather long, flat leaves and diffuse capillary panicles 15 to 30 cm. long.—Dry grounds, western Texas and (?) Mexico. May–July.

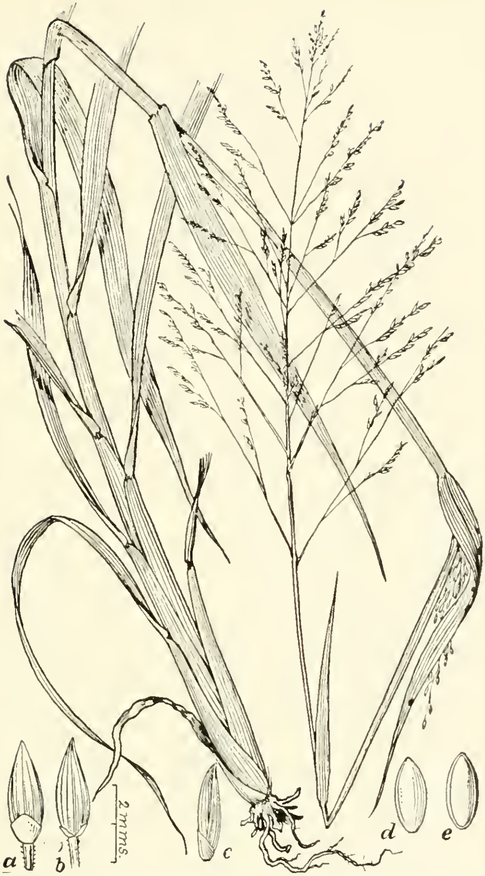


Fig. 51. **Panicum proliferum** Lam. Sprouting Crab-grass.—A smooth and usually much-branched, native annual, with rather coarse, spreading, or ascending stems 6 to 18 dm. long, flat leaves and diffuse terminal and lateral panicles.—Low ground, ditches, etc., Maine to Illinois and Nebraska, south to Florida and Texas. [Cuba]. March-October.

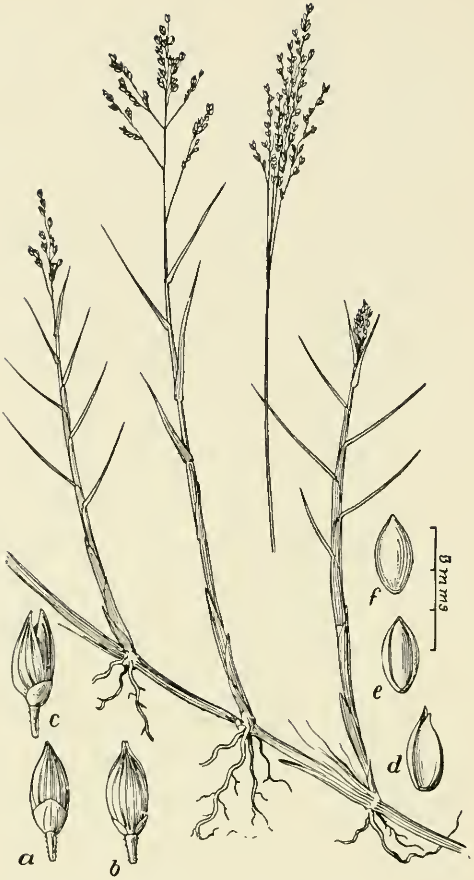


FIG. 52. **Panicum repens** L.; Beal, Grasses N. Am., **2**: 127. CREEPING PANIC.—An extensively creeping, maritime grass, with rather stiff leaves and rigid, upright, flowering stems or branches 2 to 5 dm. high.—Sea beaches, southern Alabama to Louisiana. [Tropical and subtropical coasts of both hemispheres.] A good sand-binder.

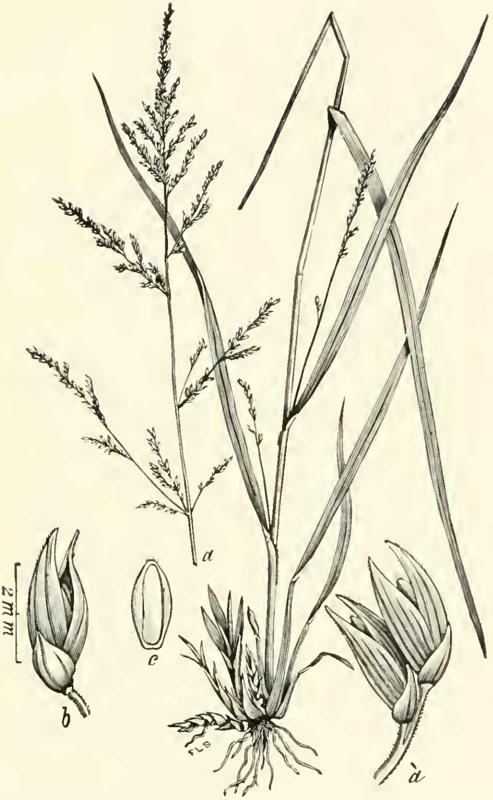


FIG. 53. **Panicum anceps** Michx. FLAT-STEMMED PANIC.—A rather stout perennial, with flattened stems 6 to 12 dm. high, long leaves, smooth or pilose sheaths, spreading panicles and pointed spikelets.—Low woods and thickets, marshes and banks of streams, Pennsylvania to Illinois, Missouri, Indian Territory, Texas, and Florida. July-October.

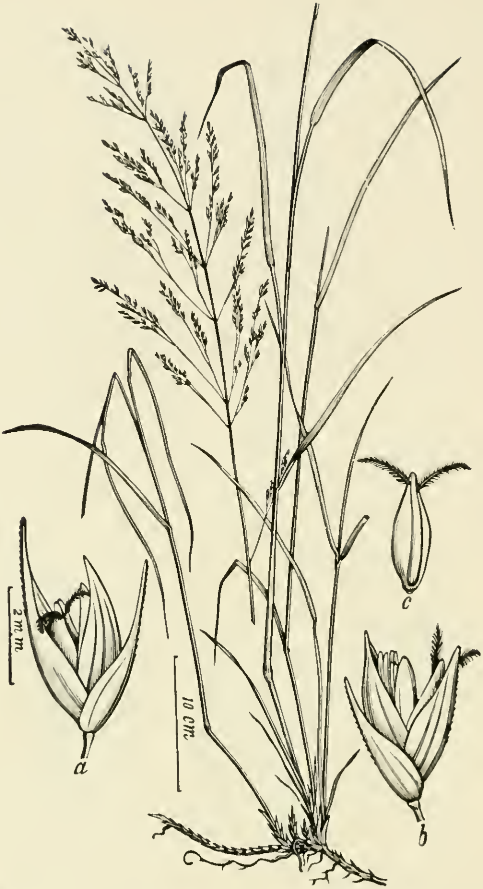


Fig. 54. **Panicum virgatum L.** Switch-grass.—A stout, erect perennial 9 to 15 dm. high, usually forming large tufts, with strong, creeping rootstocks, long, flat leaves, and ample, spreading panicles.—Sandy soil, usually along streams and about ponds and lakes, Maine and Ontario to North Dakota, Colorado, Arizona, Texas, and Florida. [Mexico.] July-October.

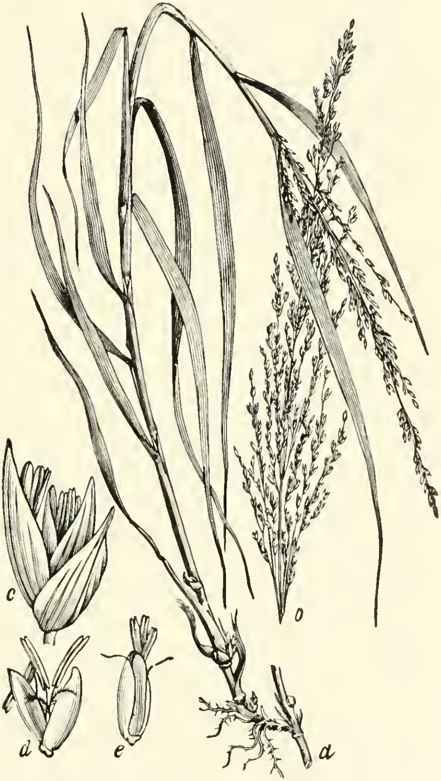


FIG. 55. **Panicum amarum** Ell. BITTER PANIC-GRASS.—A stout, coarse perennial 3 to 12 dm. high, from strong, creeping rootstocks, with rather long (30 to 40 cm.), rigid leaves and many-flowered, open panicles 10 to 30 cm. long.—Sandy beaches, coast of southern New England to southern Florida. July–November. A good sand binder.

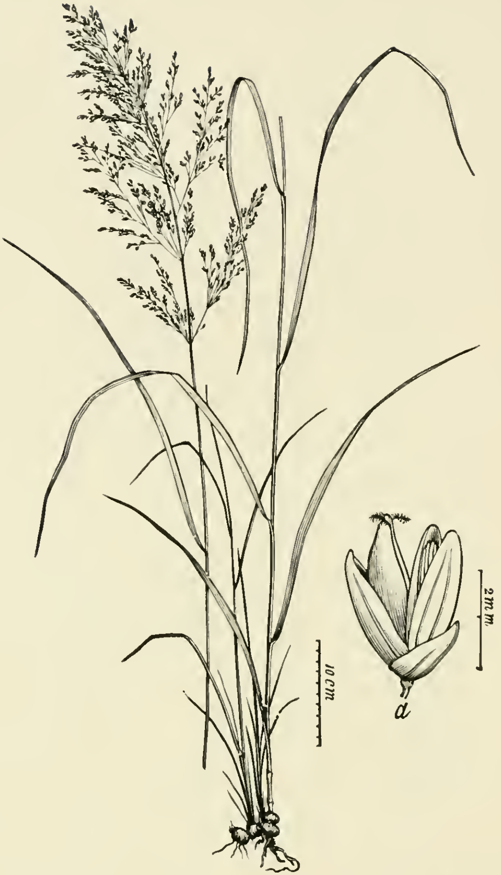


FIG. 56. **Panicum bulbosum** HBK.; Beal, Grasses N. Am., **2**: 131. ALKALI SACCATONE.—A stout, glabrous perennial 9 to 12 dm. high, from a bulbous base, with flat leaves and usually ample panicles 20 to 40 cm. long.—In canyons. Texas to Arizona. [Mexico.] June–September. A valuable hay grass for alkaline soils.

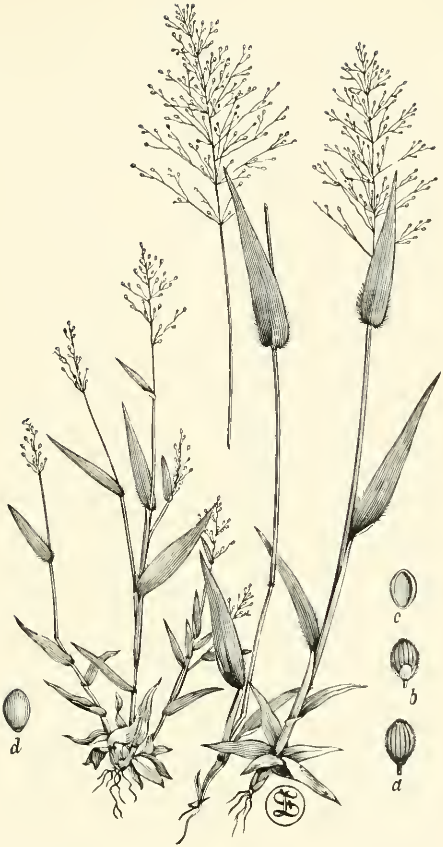


Fig. 57. **Panicum sphærocarpon** Ell.; Britton and Brown, Ill. Fl., **1**: 116. Round-flowered Panic.—A tufted, erect, or ascending perennial 25 to 60 cm. high, with rather broad, firm, and nearly erect leaf blades, diffuse many-flowered panicles and small, rounded spikelets.—Dry or moist woods and fields, Maine to southern Ontario, Wisconsin, Indian Territory, Texas, and Florida. [Mexico and Guatemala.] May–October.

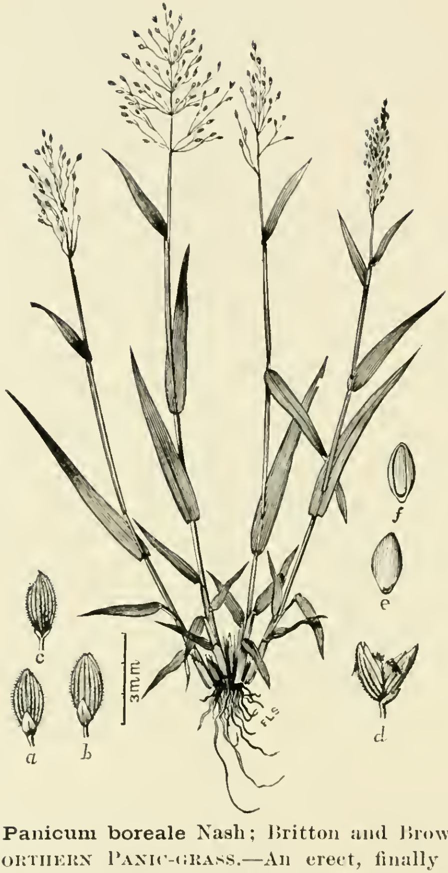


FIG. 58. **Panicum boreale** Nash; Britton and Brown, Ill. Fl., **1**: 119. NORTHERN PANIC-GRASS.—An erect, finally branching perennial 3 to 6 dm. high, with flat leaves and open, spreading panicles 4 to 8 cm. long.—Damp soil, Newfoundland and Ontario to Maine, New York, and Minnesota. June–August.

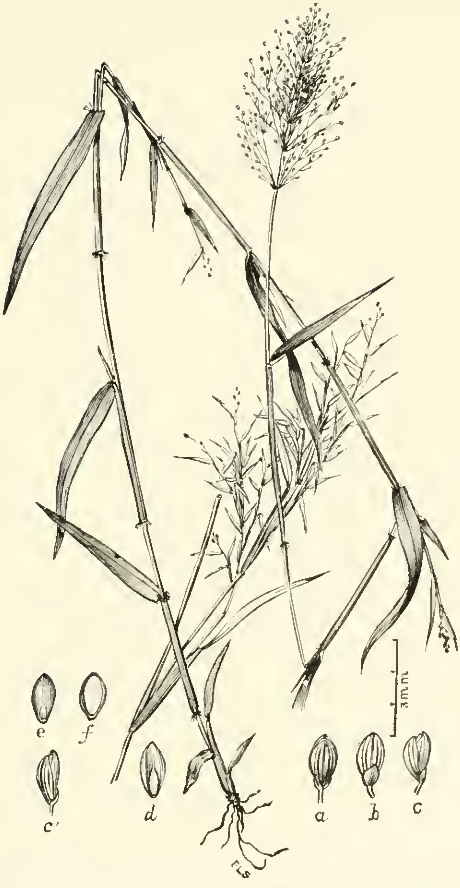


FIG. 59. **Panicum barbulatum** Michx. BEARDED-JOINT.—Culms 3 to 9 dm. high, finally much-branched, slender, smooth, except the nodes, which are conspicuously barbed with reflexed, white hairs, panicle ovate-pyramidal, spikelets numerous, small.—Bogs, wet meadows. and low woodlands, southern New York to Illinois, Florida, and New Mexico.

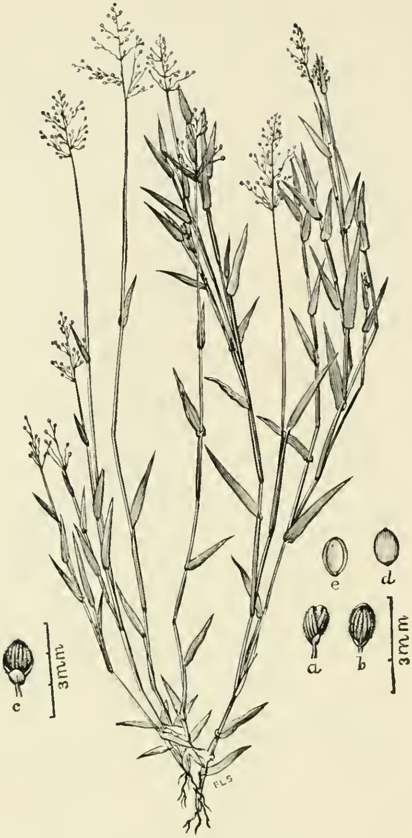


FIG. 60. **Panicum columbianum** Scribn. sp. nov. AMERICAN PANIC-GRASS.—A slender, erect, much-branched, pubescent or glabrous perennial, with short (usually 3 to 4 cm. long), lanceolate, ascending, acute leaves, and small-flowered, diffuse, oblong or subpyramidal panicles. Spike-lets about 2 mm. long. Branches finally erect, numerous, flower-bearing.—Dry, sandy fields, meadows, and open woodlands, New England southward to the Carolinas, and westward to Tennessee and Alabama, mostly near the coast; also in California. June–August.

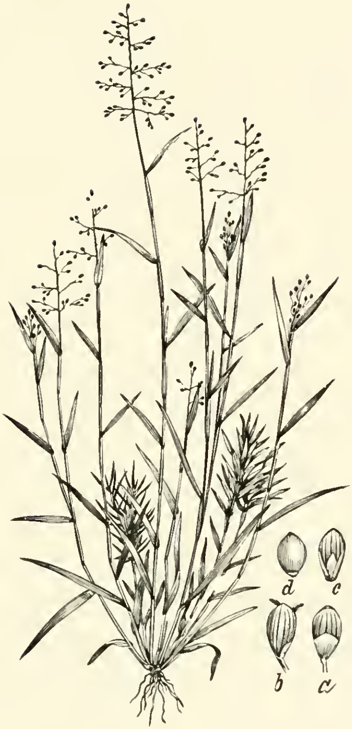


FIG. 61. **Panicum nashianum** Scribn. sp. nov. (allied to *P. demissum* Trin.). NASH'S PANIC-GRASS.—A slender and finally much-branched, leafy perennial 1 to 3.5 dm. high, with flat and rather short leaves, which are ciliate on the margins toward the base, and open pyramidal panicles, the flexuose branches widely spreading or reflexed. (4,029 Curtiss (1893), and 466 Nash (1894).)—Low pine barrens, often in moist ground, near the coast, Virginia to Mississippi. [Brazil.] March–October.

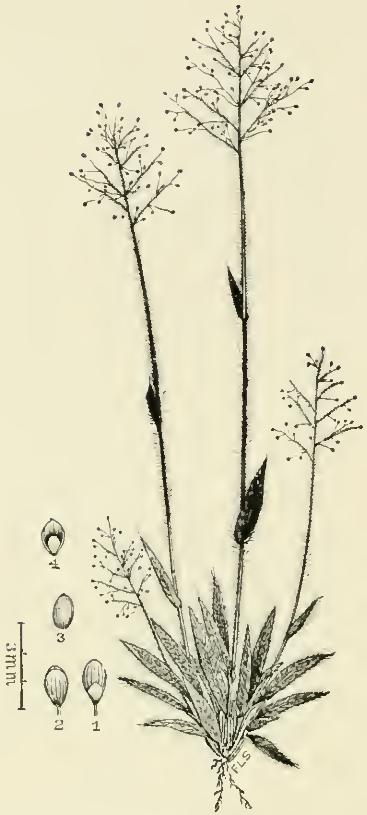


Fig. 62. **Panicum longipedunculatum** Scribn.; Bull. Tenn. Agr. Exp. Station, VII, **1** : 53. LONG-STALKED PANIC.—A slender, cæspitose perennial 1.5 to 3 dm. high, with short, chiefly radical, pilose leaves and diffuse, small-flowered, long-exserted, hairy panicles.—Dry or moist pine barrens and damp woods, apparently rare, eastern Tennessee to eastern North Carolina and Florida. May–August.

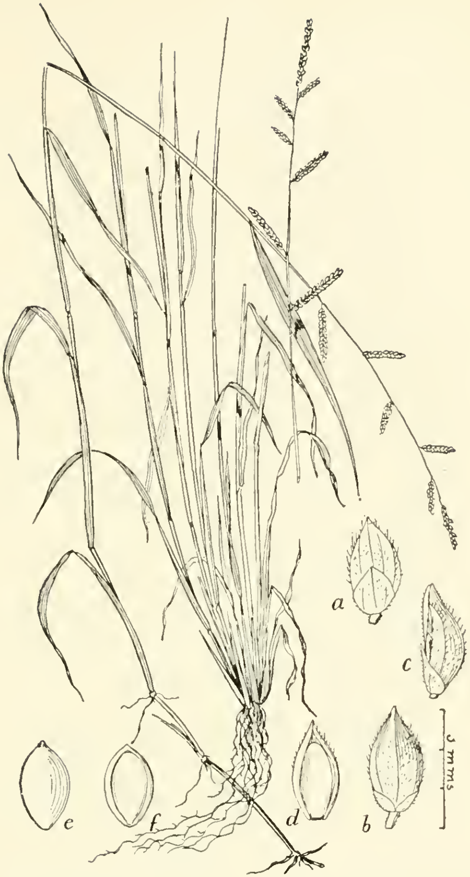


FIG. 63. **Panicum colonum** L. JUNGLE RICE.—An erect or ascending, more or less branching annual 3 to 6 dm. high, wiht flat leaves and five to ten, densely flowered, one-sided spikes, 1 to 3 cm. long, racemose along the main axis.—Ditches and low ground, Southeastern Virginia and Tennessee to Florida, Texas, and southern California. [Widely distributed in tropical and subtropical regions of the Old World.] June–October.

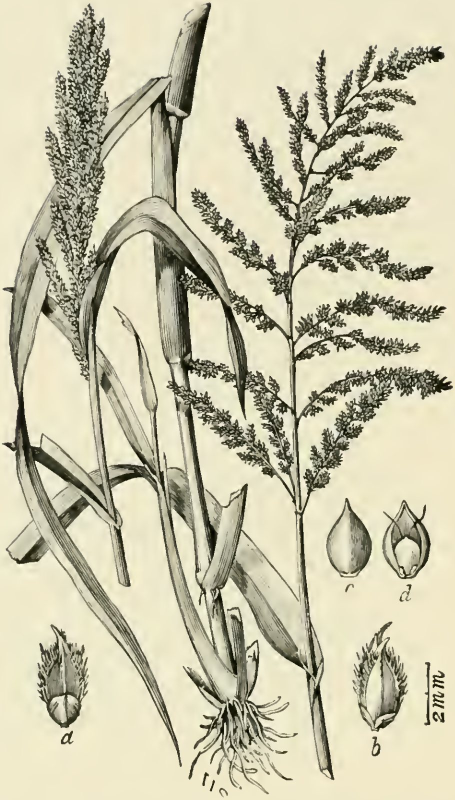


FIG. 64. **Panicum crus-galli L.** BARNYARD-GRASS.—A coarse, ascending or erect, leafy annual 3 to 15 dm. high, with dense panicles and with the third glume awnless to long-awned.—Almost everywhere in the United States in barnyards, waste ground, and river banks. Throughout the warmer regions of both hemispheres. Flowers all summer.

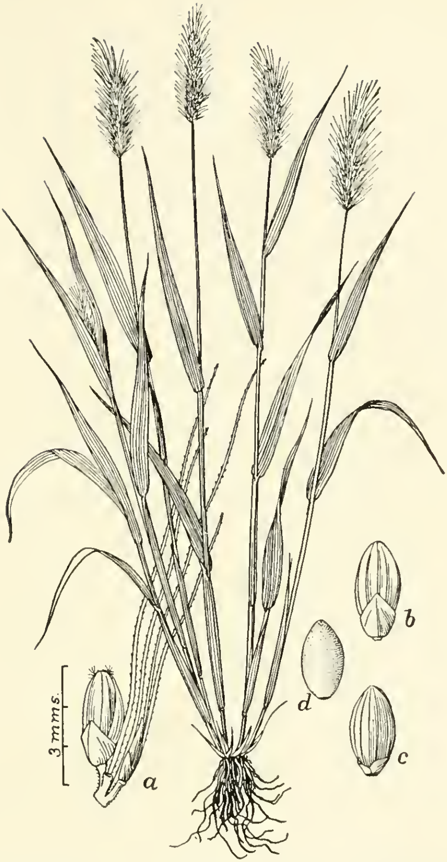


Fig. 65. **Chætochloa viridis** (L.) Scribn. (*Panicum viride* L., *Setaria viridis* Beauv.). Green Foxtail.—A branching, leafy annual 3 to 6 dm. high, with bristly, densely many-flowered, spike-like panicles 5 to 10 cm. long. Bristles usually green and spikelets smaller than in Yellow Foxtail (*Chætochloa glauca*).—A weed in cultivated and waste grounds; naturalized from Europe. June–October.

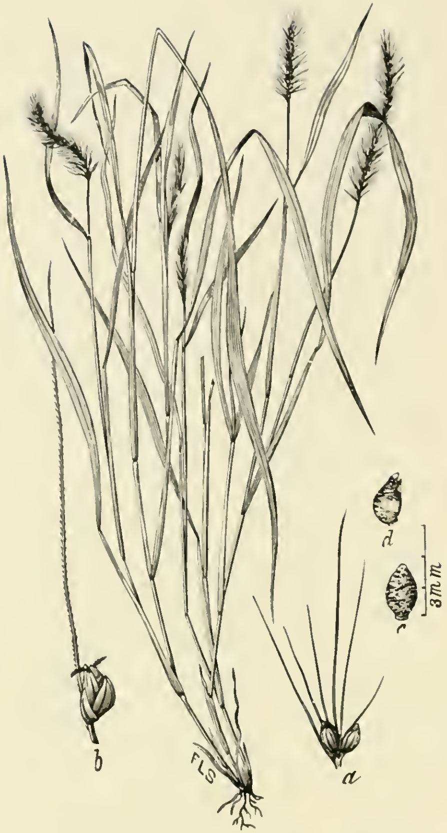


FIG. 66. **Chætochloa corrugata** (Ell.) Scribn. (*Panicum corrugatum* Ell.; *Setaria corrugata* Schult.). ROUGH FOXTAIL.—A rather slender annual 3 to 9 dm. high, usually much branched below, with flat leaves and bristly, spike-like panicles 3 to 10 cm. long.—Usually in cultivated land, Georgia and Florida. May–October.

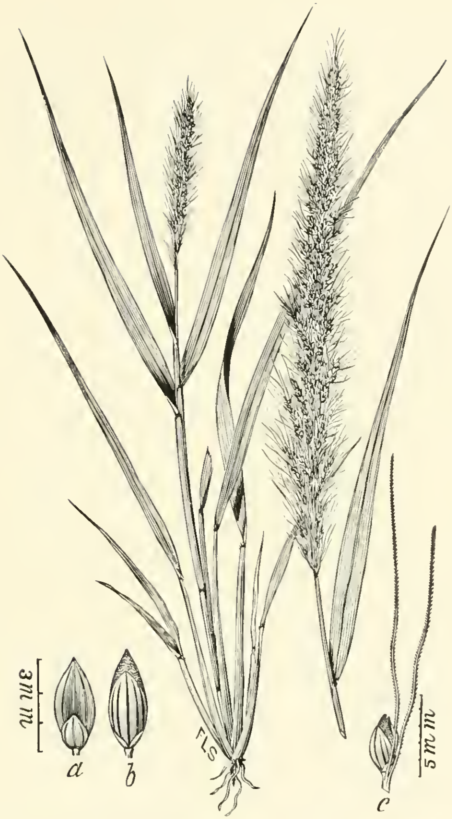


FIG. 67. **Chætochloa composita** Scribn. (*Setaria composita* HBK.?). BRANCHING FOXTAIL.—A stout perennial 6 to 12 dm. high, with broad, flat leaves, and branching, bristly panicles 10 to 25 cm. long. Spikelets 3 mm. long; second glume one-third shorter than the fourth. (No. 3617, A. H. Curtiss.)—Shell islands and keys, sometimes in old pineapple fields, southern Florida. [West Indies.] July–October.

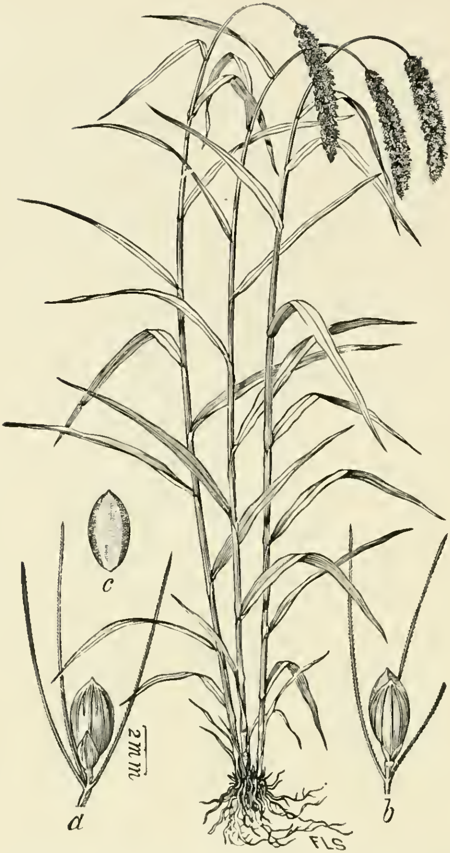


Fig. 68. **Chætochloa italica** (L.) Scribn. (*Setaria italica* Beauv.). Italian Millet or Hungarian-grass.—A stout and rapidly growing leafy annual 10 to 24 dm. high, with large compound, nodding, bristly, and nearly cylindrical panicles 20 to 40 cm. long —In cultivated and waste land, escaped from cultivation or adventive here and there throughout the country. [Europe, Asia.] July, August.

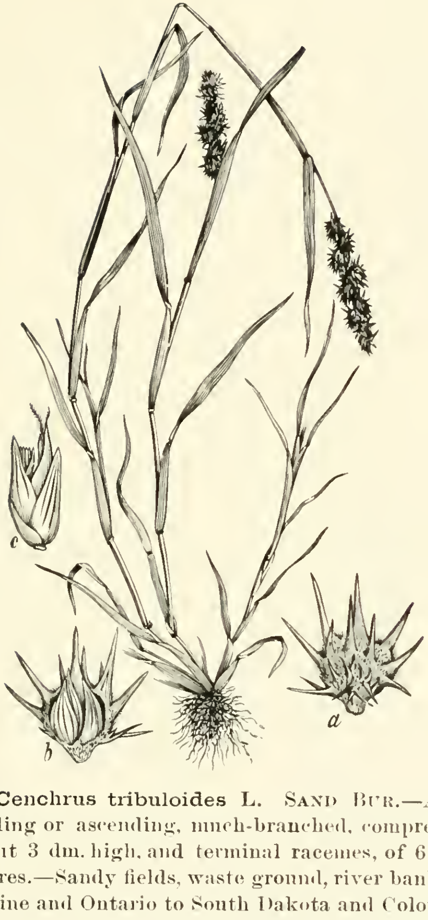


FIG. 69. **Cenchrus tribuloides L.** SAND BUR.—An annual, with spreading or ascending, much-branched, compressed culms usually about 3 dm. high, and terminal racemes, of 6 to 20 bur-like involucres.—Sandy fields, waste ground, river banks, and sea beaches, Maine and Ontario to South Dakota and Colorado, south to Florida and southern California. [Mexico and South America.] June–October.

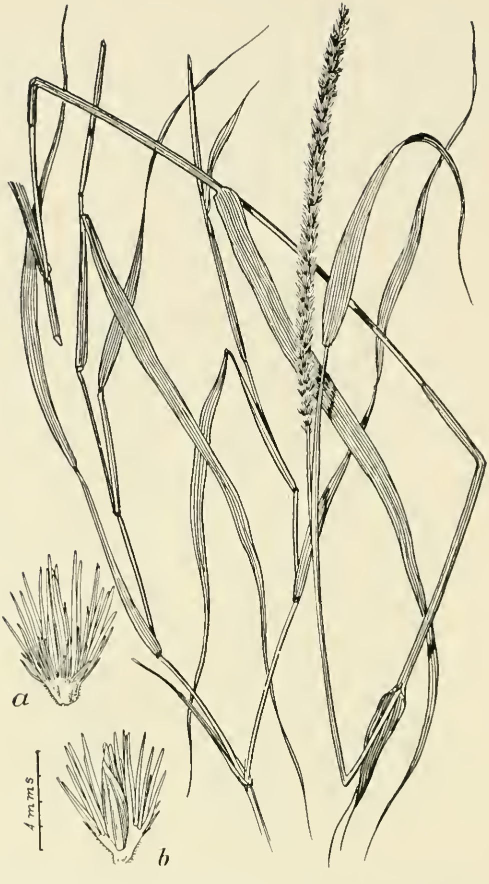


FIG. 70. **Cenchrus myosuroides** HBK.; Beal, Grasses N. Am., **2**: 160. LONG-SPIKED BUR-GRASS.—A stout perennial 6 to 8 dm. high, more or less branching and geniculate below, with flat leaves and long, cylindrical spikes 12 to 20 cm. long.—Waste ground, introduced; southern Florida to Texas. [Mexico, South America.) August–January.

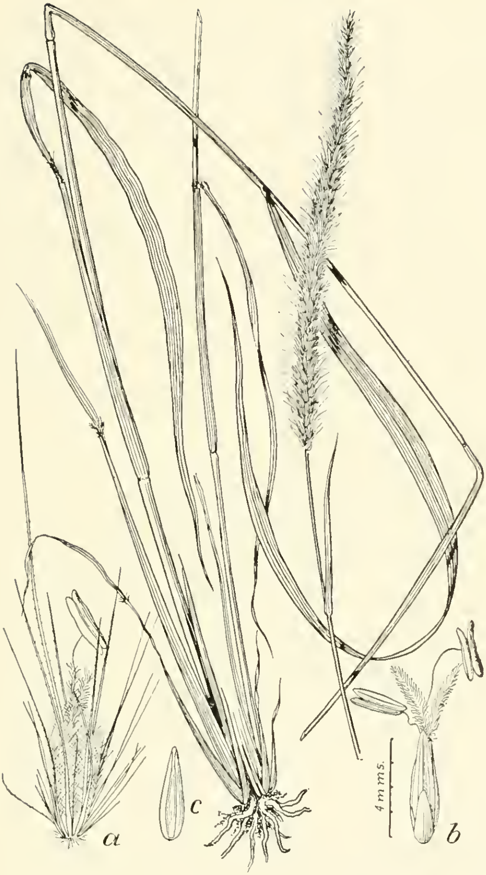


FIG. 71. **Pennisetum setosum** (Sw.) Rich.; Beal, Grasses N. Am., **2**: 166.—A stout, branching perennial 9 to 12 dm. high, with flat leaves and dense, bristly, cylindrical spikes 10 to 15 cm. long.—Southern Florida. [Widely distributed in tropical countries.] September.

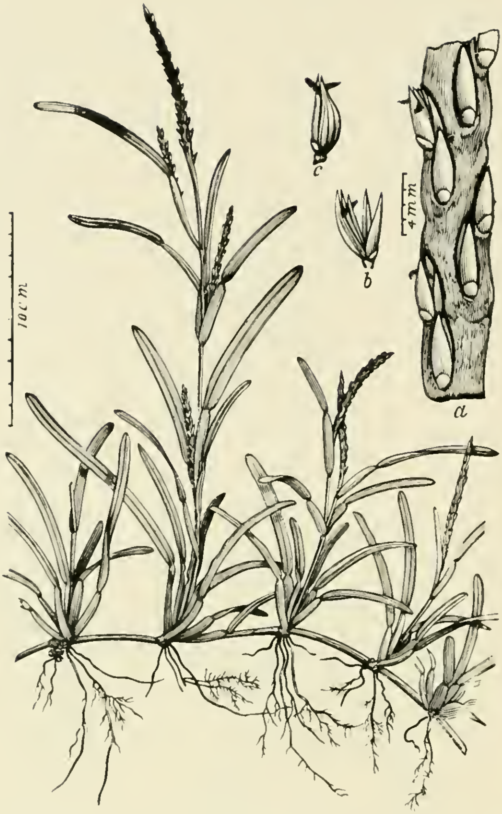


FIG. 72. **Stenotaphrum secundatum** (Walt.) Kuntze (*Ischæmum secundatum* Walt.; *Stenotaphrum americanum* Schrank.). MISSION-GRASS.—Extensively creeping perennial, with hard, flat stems, rather broad leaves, and upright, flowering stems 1.5 to 3 dm. high.—Muddy or moist sandy shores and marshes along the coast, South Carolina to Florida and Louisiana. [Widely distributed in tropical America and the Pacific islands.] April–October.

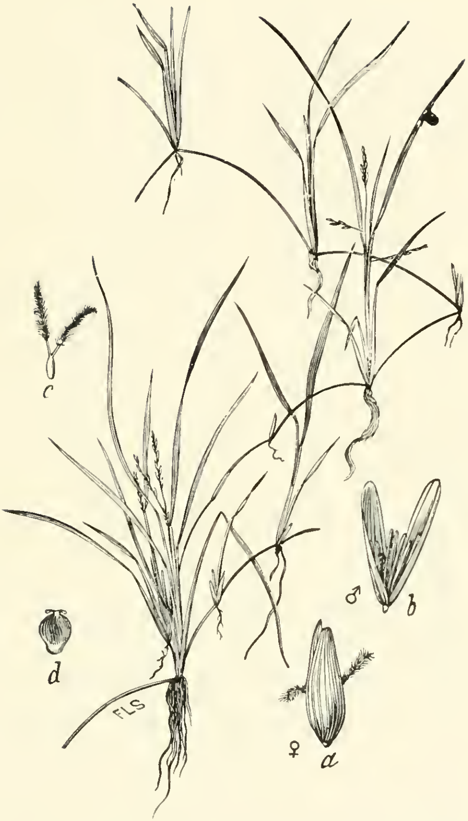


FIG. 73. **Luziola alabamensis** Chapm.: Beal, Grasses N. Am., **2**: 172.—An aquatic, stoloniferous grass, the upright culms 0.5 to 1.5 dm. high, with long, narrow leaves and the staminate and pistillate spikelets in separate panicles.—In springy places and rivulets in the pine barrens, southern Alabama. [Cuba.] June–October.

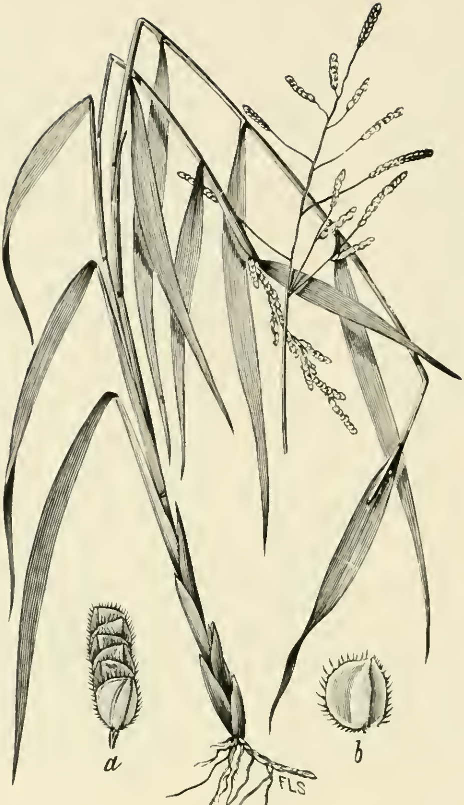


FIG. 74. **Homalocenchrus lenticularis** (Michx.) Scribn. (*Leersia lenticularis* Michx.). CATCH-FLY-GRASS.—A rather stout, branching perennial 6 to 12 dm. high, with widely spreading, broad leaf blades, diffuse panicles, and large, ciliate spikelets.—Marshes and wet thickets, near the coast, Virginia to Texas, and in the Mississippi Valley from southern Illinois and Missouri to Louisiana. August, September.

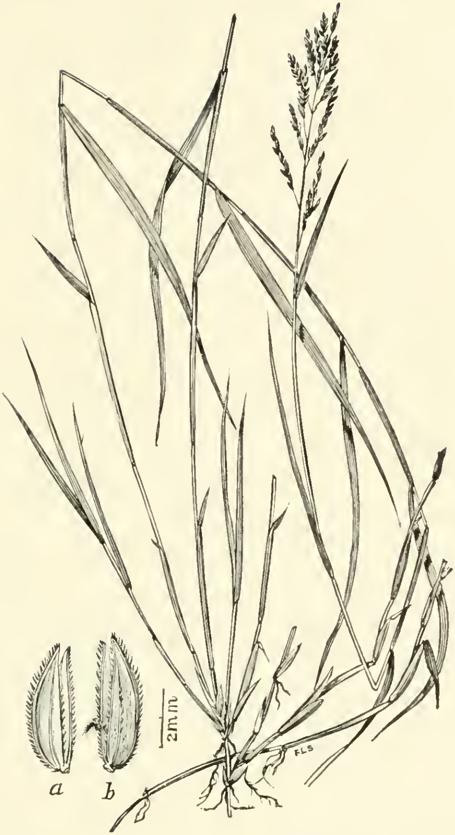


FIG. 75. **Homalocenchrus hexandrus** (Sw.) Britton; Beal Grasses N. Am., **1**: 179 (*Leersia hexandra* Sw.).—A rather slender, usually erect, branching grass 6 to 12 dm. high, with narrow, many-flowered panicles 10 to 15 cm. long.—In swamps and ditches near the coast, North Carolina to Florida and Texas. [In all tropical and many subtropical countries.] May–September.

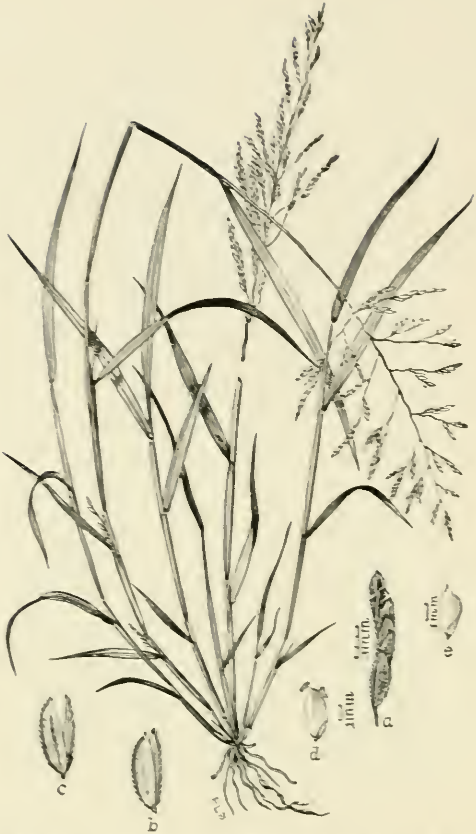


FIG. 76. **Homalocenchrus oryzoides** (Sw.) Poll. (*Leersia oryzoides* Sw.): Britton and Brown. Ill. Fl., 1: 129. RICE CUT-GRASS.—A rather stout, rough, and much-branched grass 6 to 12 dm. high, with open, pale-green or straw-colored panicles 12 to 25 cm. long.—Along streams and ditches and in marshes, usually in the open. Nova Scotia and Ontario to Washington, Florida, and Texas. [Europe and Asia.] August–October.

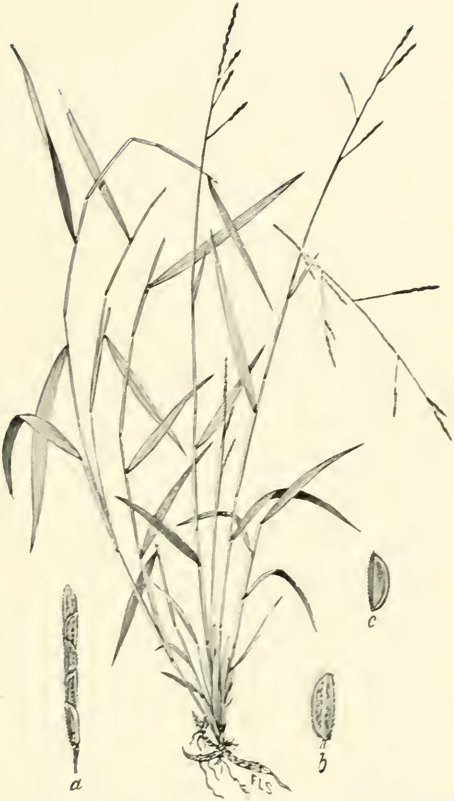


FIG. 77. **Homalocenchrus virginicus** (Willd.) Britton. (*Leersia virginica* Willd.). WHITE-GRASS.—A slender, erect, or ascending, usually much-branched, perennial 6 to 12 dm. high, with narrow leaves and simple panicles 8 to 12 cm. long.—Moist thickets and low woods, usually along streams, Maine and Ontario to South Dakota, southward to Florida, and Texas. May–October.

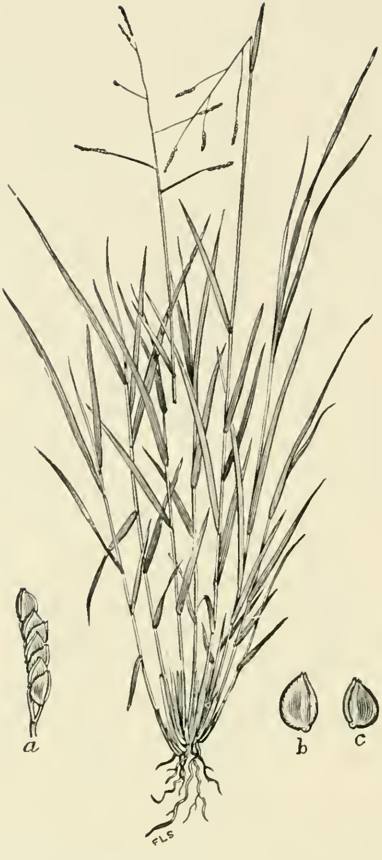


FIG. 78. **Homalocenchrus monandrus** (Sw.) Britton (*Leersia monandra* Sw.); Beal, Grasses N. Am., **2**: 179. SLENDER CUT-GRASS.—A slender, sparingly branched grass with somewhat wiry culms 3 to 6 dm. high, and usually glaucous leaves.—Keys of south Florida (in coral soil) and in southern Texas. [Mexico, West Indies, and South America.] February–May.

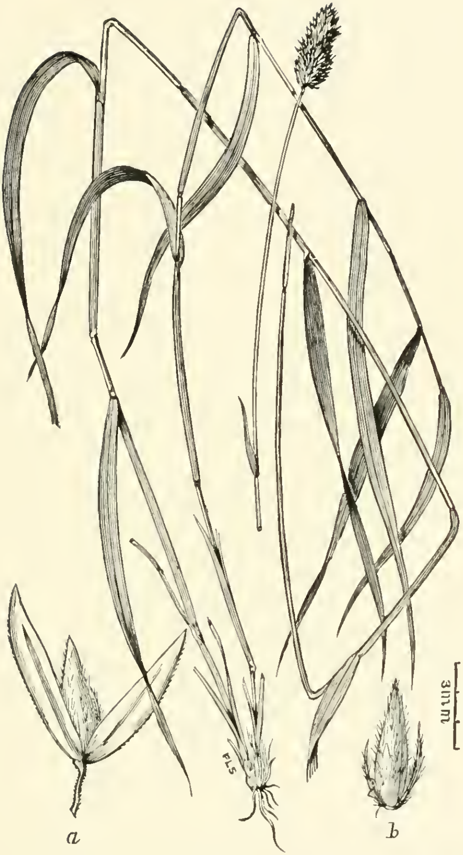


Fig. 79. **Phalaris amethystina** Trin.; Beal. Grasses N. Am., **2**: 183. Purple Canary-grass.—A stout annual 4 to 9 dm. high, with broad, flat leaves, and ovoid or oblong, densely-flowered terminal panicles.—Oregon to California and southward to Chile. June.

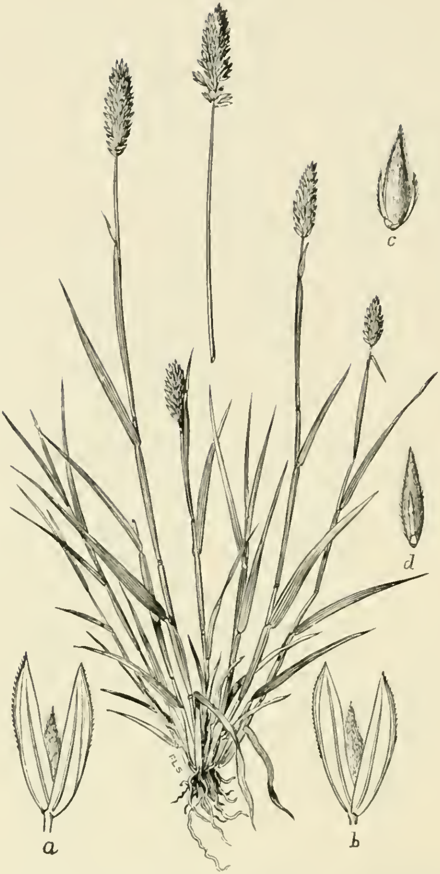


FIG. 80. **Phalaris caroliniana** Walt. (*P. intermedia* Bosc.). SOUTHERN CANARY-GRASS.—A comparatively slender species 3 to 6 dm. high, with rather short, flat leaves, and ovoid, densely flowered, capitate panicles 2 to 5 cm. long.—River bottoms and wet places, South Carolina to Indian Territory, Texas, Nevada, California, and Oregon. April.

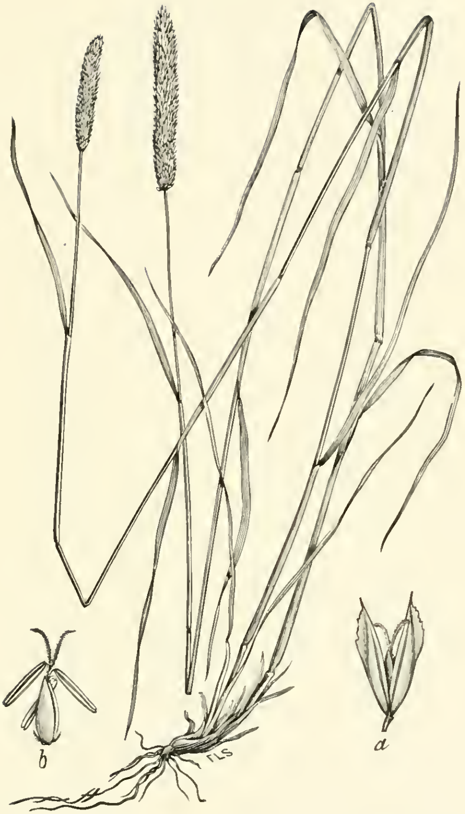


FIG. 81. **Phalaris angusta** Nees (*P. intermedia angusta* Chapm.). CALIFORNIA TIMOTHY.—A stout grass 6 to 14 dm. high, with narrow, densely flowered, spike-like panicles 6 to 12 cm. long.—In wet places, South Carolina and Louisiana to southern California. [South America.] May. Cultivated to a limited extent in the Southern States.

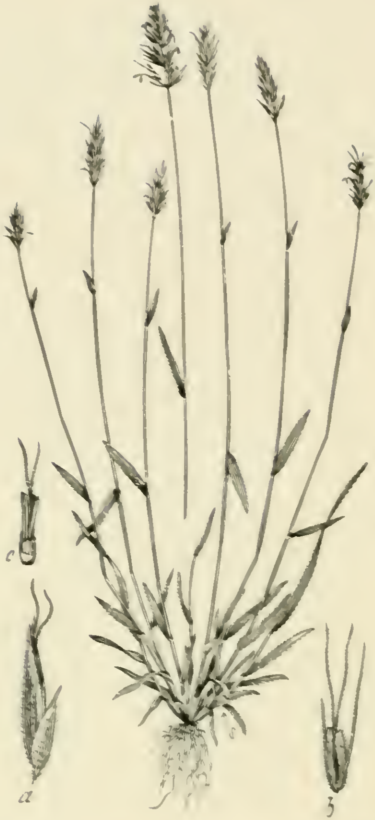


Fig. 82. **Anthoxanthum odoratum** L. Sweet Vernal-grass.—A sweet-scented grass, with slender, erect, tufted culms, flat leaf-blades and narrow, spike-like terminal panicles.—Abundantly naturalized in lawns, fields, and waysides from Newfoundland and Ontario to North Carolina and Tennessee. [Europe, northwestern Asia, and northern Africa.] May–September.

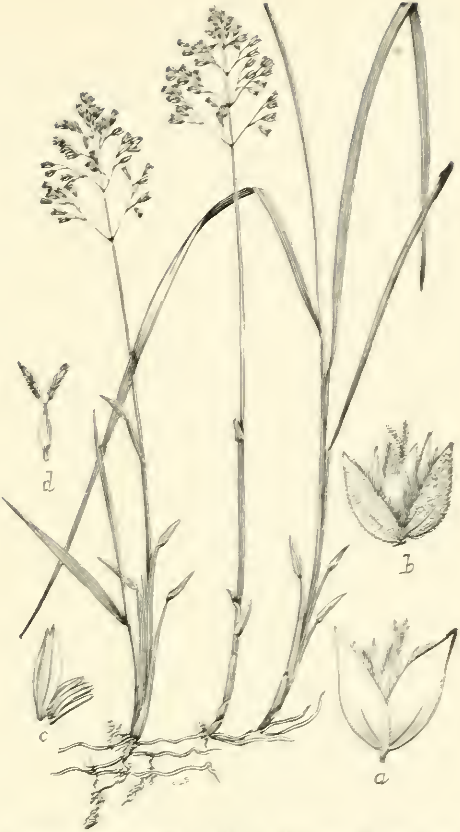


FIG. 83. **Savastana odorata** (L.) Scribn. (*Hierochloë borealis* R. & S.). VANILLA-GRASS.—A slender, sweet-scented, stoloniferous perennial 3 to 6 dm. high, with short culm-leaves and brownish, open panicles. The flat leaves of the sterile shoots are 1 to 3 dm. long.—Newfoundland and New Brunswick to southern New York, west to Minnesota and Iowa; in the Rockies from British America south to Arizona and Mexico; Alaska southward in the mountains to Oregon. [Cooler temperate regions and high mountains of both hemispheres.] April–August.

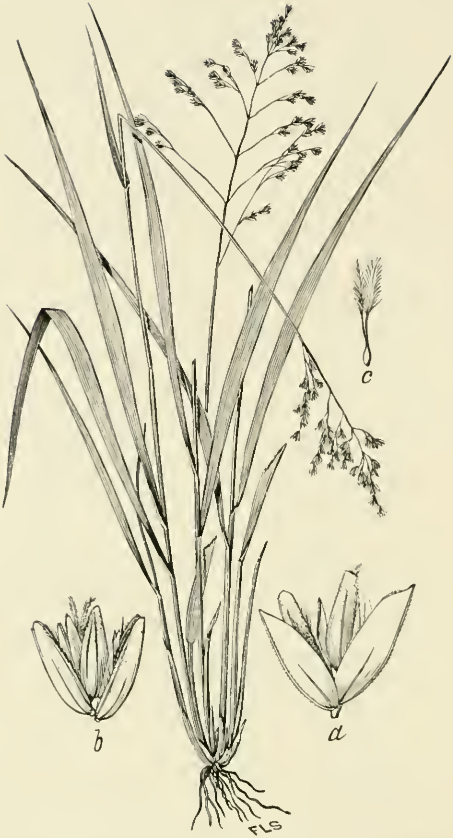


Fig. 81. **Savastana macrophylla** (Thurb.) (*Hierochloë macrophylla* Thurb.); Beal, Grasses N. Am., **2**: 187. Large-leafed Vanilla-grass.—A rather stout, native perennial 6 to 10 dm. high, with long and broad leaves and loosely flowered panicles, usually about 4 inches long.—Coniferous woods, California and Oregon. March-May.

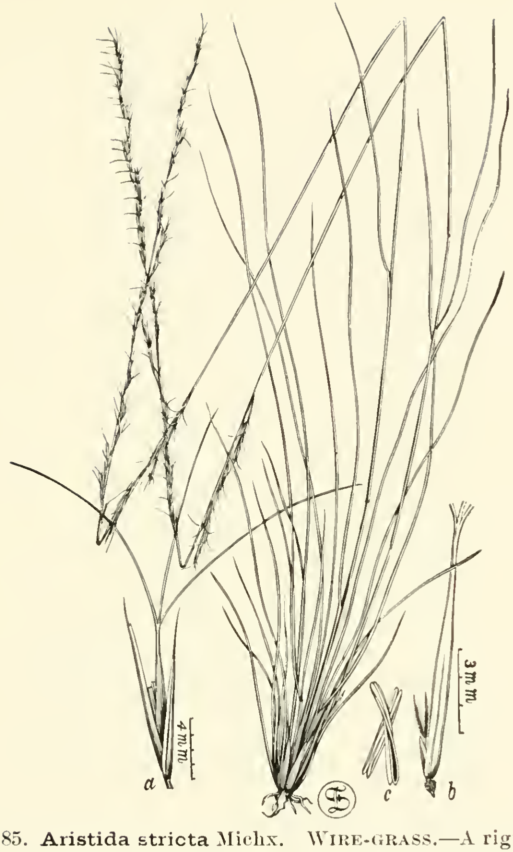


Fig. 85. **Aristida stricta** Michx. Wire-grass.—A rigid, erect wiry perennial 6 to 12 dm. high, with narrow, involute leaves and strict, spike-like panicles about 30 cm. long.—Dry pine barrens near the coast, Virginia (?) and North Carolina to Mississippi, often covering extensive tracts and forming the bulk of the pasturage. July–October.

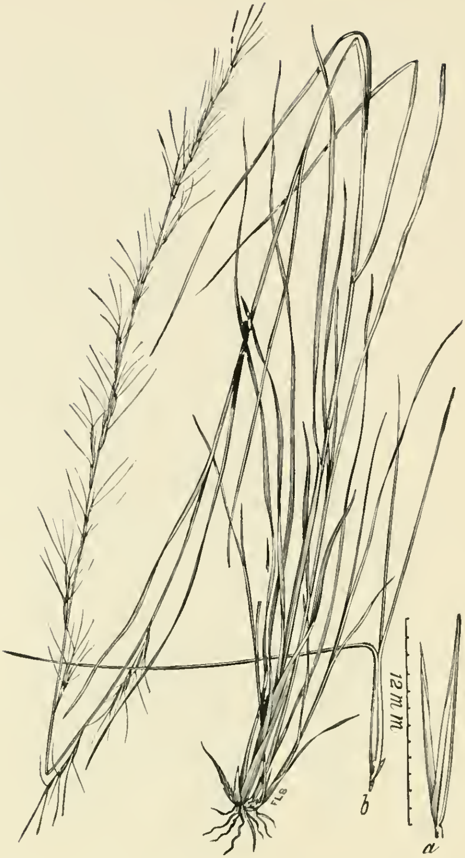


Fig. 86. **Aristida palustris** (Chapm.) Vasey (*A. virgata palustris* Chapm.). Swamp Poverty-grass.—An upright, rigid perennial 6 to 15 dm. high, with long, narrow leaves, and slender, interrupted, spicate panicles 30 to 70 cm. long.—Moist places near the coast in the pine barrens, South Carolina to Texas. [Cuba.] August–October.

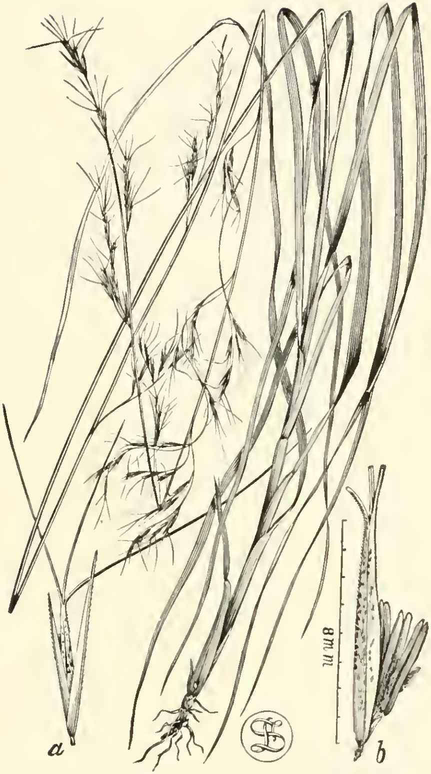


FIG. 87. **Aristida gossypina** Bosc (*A. lanata* Poir.). WOOLY POVERTY-GRASS.—A rather stout perennial, with simple stems 6 to 12 dm. high, and narrow panicles 30 to 60 cm. long. Lower sheaths usually wooly.—Dry pine barrens, mostly near the coast, Delaware to Texas and Indian Territory. September–November.

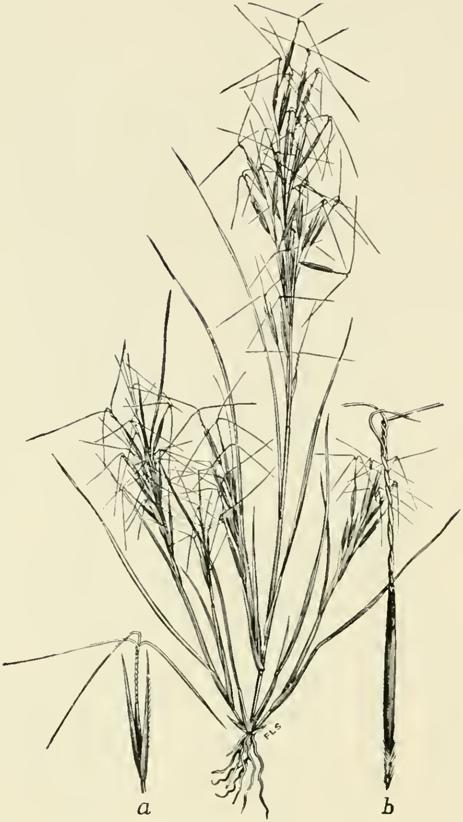


Fig. 88. **Aristida tuberculosa** Nutt. Long-awned Poverty-grass.—A rigid, much-branched perennial 3 to 4.5 dm. high, with nearly simple panicles 10 to 18 cm. long. The widely spreading, nearly equal awns 3 to 4 cm. long.—Dry, sandy soil, near the coast, Massachusetts to Mississippi; also in Illinois, Wisconsin, and Minnesota. August–October.

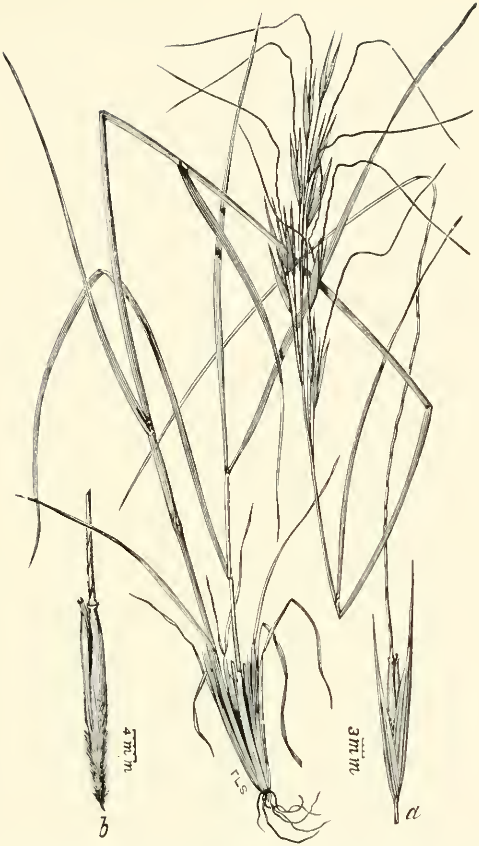


FIG. 89. **Stipa spartea** Trin. PORCUPINE-GRASS.—A stout, erect perennial, with simple culms 6 to 10 dm. high, long, narrow leaves and few-flowered panicles. The strong, twisted awns are 8 to 15 cm. long, and at the base of the flowering glume is a long, pointed, and bearded callus.—Prairies, Illinois to Colorado, north to Manitoba and British Columbia. June–August.

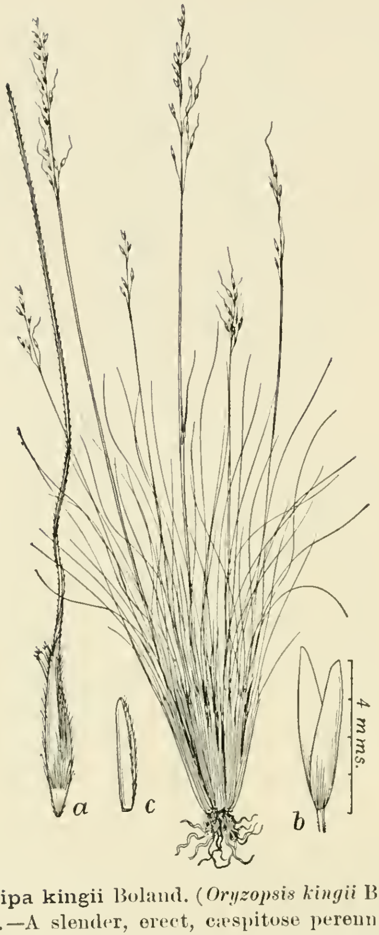


FIG. 90. **Stipa kingii** Boland. (*Oryzopsis kingii* Beal, Grasses N. Am., **2**: 229).—A slender, erect, cæspitose perennial 2 to 4 dm. high, with involute, filiform leaves and contracted panicles 8 to 12 cm. long. Awns scabrous.—California and (?) Nevada.

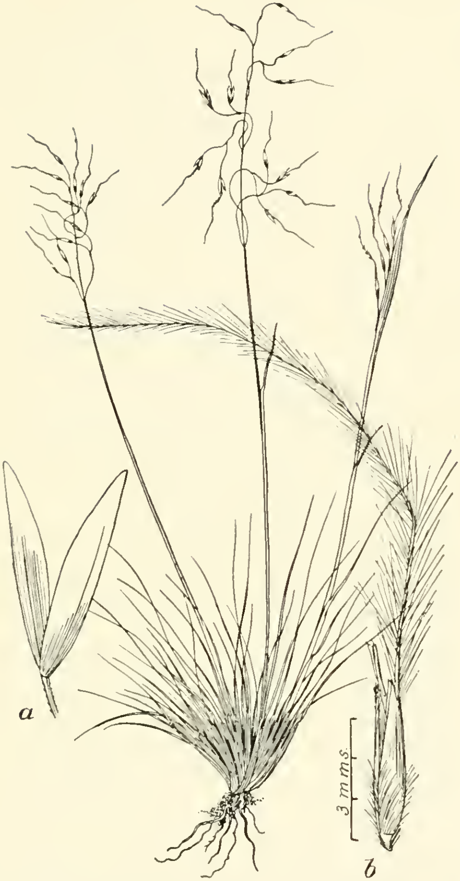


Fig. 91. **Stipa mongolica** Trin.; Beal. Grasses N. Am., **2** : 227 (sub *Oryzopsis*).—A slender, densely tufted perennial about 3 dm. high, with short, setaceous leaves and loosely few-flowered panicles. Awns plumose.—Mountains of Colorado. [Eastern Asia.]

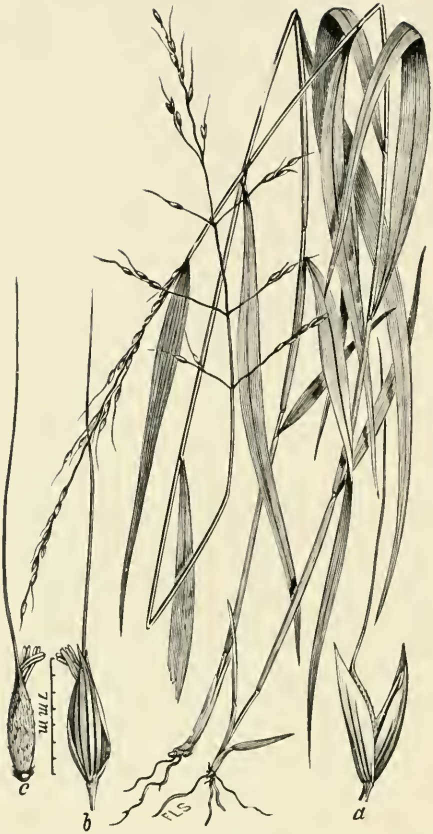


FIG. 92. **Oryzopsis melanocarpa** Muhl. BLACK MOUNTAIN RICE.—A rather stout, long- and broad-leafed perennial 3 to 9 dm. high, with narrow, simple panicles of a few, large spikelets.—Open rocky woods, sometimes on cliffs, Quebec and Ontario to Delaware, Kentucky, Missouri, and Minnesota. July–September.

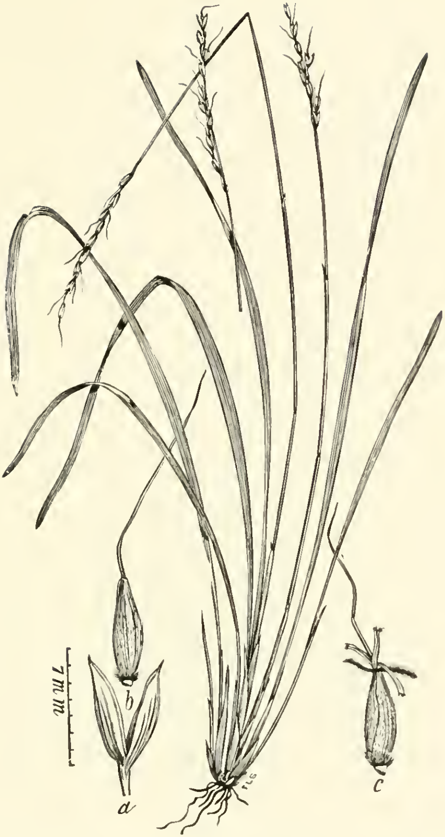


FIG. 93. **Oryzopsis asperifolia** Michx. WHITE MOUNTAIN RICE.—A slender perennial 1.5 to 5 dm. high, with narrow, simple panicles 6 to 10 cm. long. The basal leaves, which are 5 to 7 mm. wide, often overtop the culm.—Woods, Newfoundland, Massachusetts and New Jersey, to Minnesota and British Columbia, and southward in the Rockies to New Mexico. April–July.

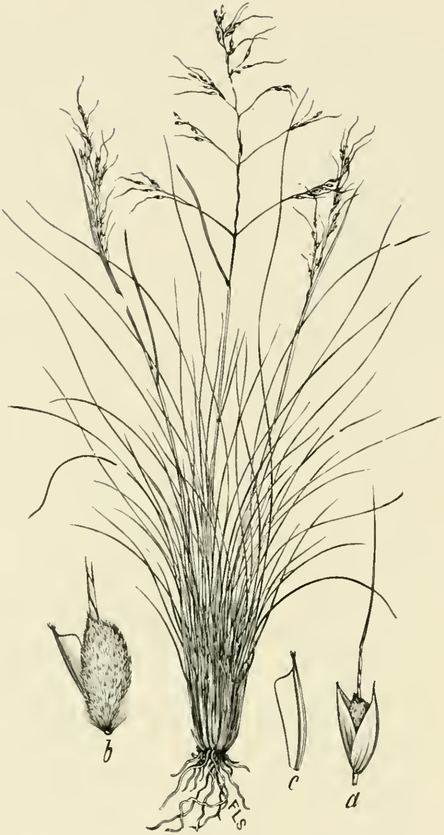


Fig. 94. **Oryzopsis fimbriata** (HBK.) Hemsl.; Beal, Grasses N. Am., **2**: 231.—A slender, tufted perennial 5 to 8 dm. high, with very narrow, involute leaves and loosely flowered panicles 10 to 13 cm. long.—In canyons and under limestone cliffs, mountains of western Texas to California. [Mexico and Lower California.] July–September.

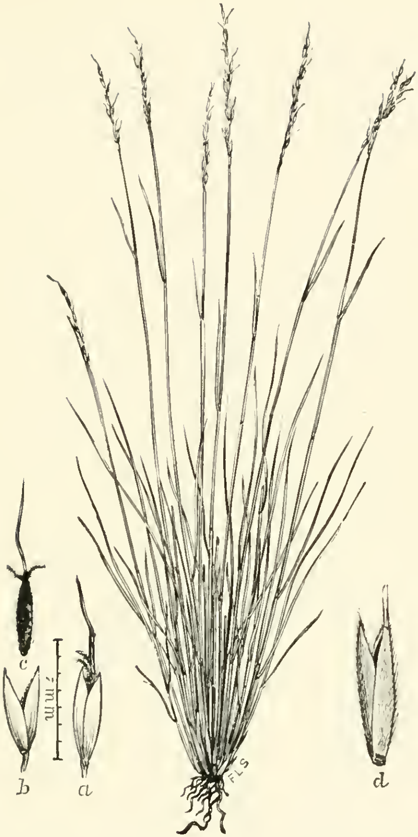


FIG. 95. **Oryzopsis exigua** Thurb.; Beal, Grasses N. Am., **2**: 227. LITTLE MOUNTAIN RICE.—A slender native perennial 1.5 to 3 dm. high, with filiform leaves, and narrow, simple, few-flowered panicles 2 to 5 cm. long.—Among rocks in canyons and on mountain tops, Montana and Wyoming to Utah, Oregon, and Washington. June–August.

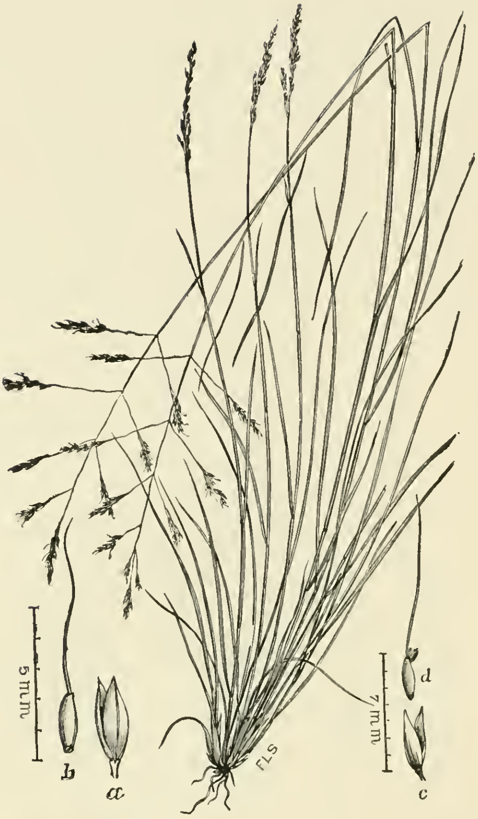


FIG. 96. **Oryzopsis micrantha** (Trin. & Rupr.) Thurb. SMALL-FLOWERED MOUNTAIN RICE.—A slender, erect perennial, usually about 6 dm. high, with narrow leaves and small-flowered, open panicles 8 to 16 cm. long.—Woods, river bluffs, and mountain sides, South Dakota to Nebraska, Colorado, New Mexico, and Arizona. June–August.

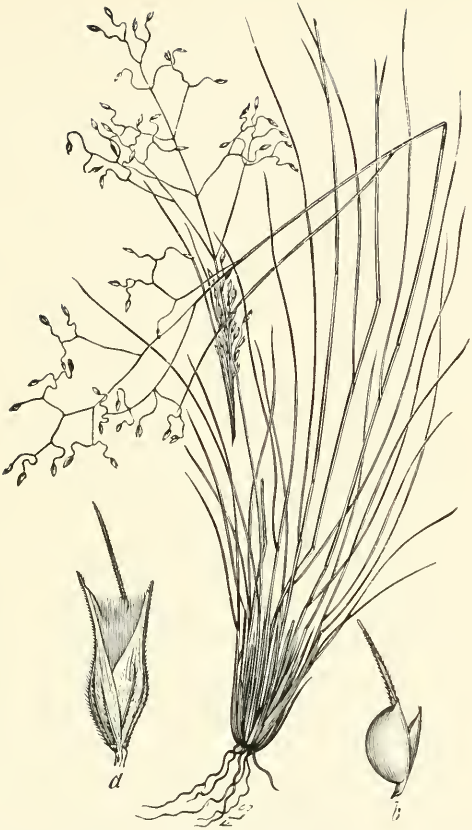


FIG. 97. **Eriocoma cuspidata** Nutt. (*Stipa membranacea* Pursh, not Linn.; *Oryzopsis membranacea* V.). INDIAN MILLET.—A native perennial, growing in bunches 3 to 7 dm. high, with narrow, involute leaves and peculiarly branched, diffuse panicles 12 to 15 cm. long.—Grassy slopes, dry hillsides, sandy river banks, about springs in deserts, in cultivated fields, etc., South Dakota to New Mexico, California, and British Columbia. [Mexico.] May–September.

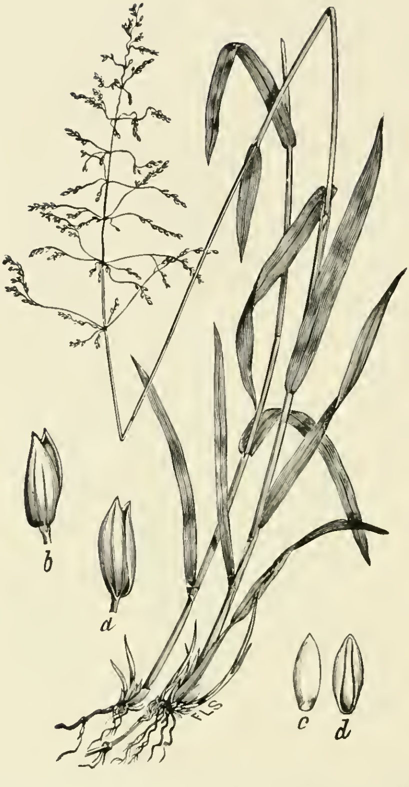


Fig. 98. **Milium effusum L.** Wild Millet.—A pale-green perennial, with simple culms 6 to 14 dm. high, broad, flat, spreading leaves and diffuse panicles 15 to 18 cm. long.—Woods and ravines, Cape Breton Island to western Ontario, Pennsylvania, Michigan, and Minnesota. [Europe, Asia.] June, July.

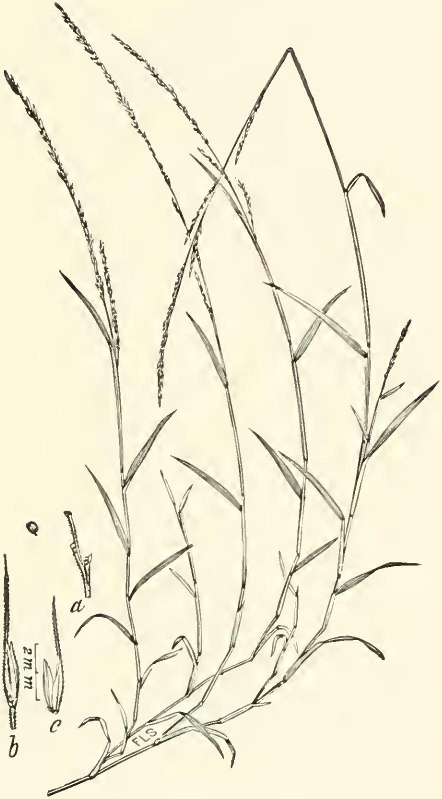


Fig. 99. **Muhlenbergia diffusa** Schreb. Nimble Will.—A low, slender perennial, with ascending, much-branched wiry culms 3 to 6 dm. long, flat leaf-blades and narrow, rather densely flowered panicles.—In shade in thickets, borders of woods, waste ground about dwellings, etc , Maine and Ontario to Minnesota, Kansas, Texas, and Florida. [Mexico (?)] August–January (in Louisiana).

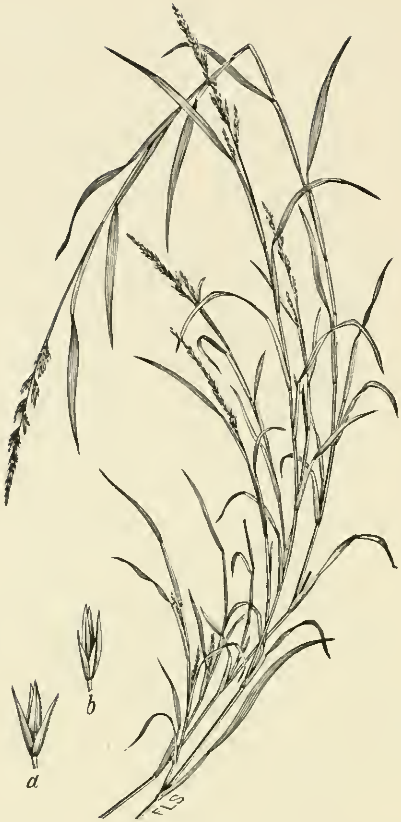


Fig. 100. **Muhlenbergia mexicana** (L.) Trin. Mexican Dropseed.—An upright or ascending, usually much-branched perennial 3 to 9 dm. high, with a scaly, creeping rootstock, numerous, flat leaf blades and contracted, densely flowered panicles.—Sandy or rocky banks of streams and low thickets, New Brunswick and Ontario to North Carolina, Indian Territory, and South Dakota.

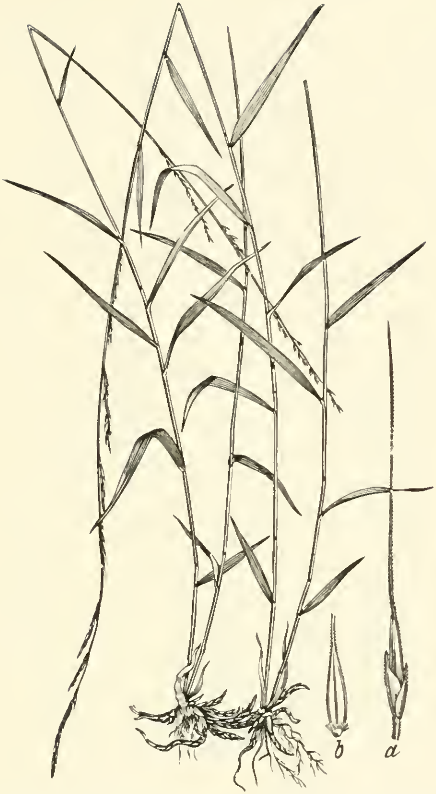


FIG. 101. **Muhlenbergia tenuiflora** (Willd.) B. S. P. (*M. willdenorii* Trin.). SLENDER-FLOWERED DROPSEED.—An erect, simple or sparingly branched perennial 3 to 9 dm. high, with creeping, scaly rootstocks, flat leaf blades and rather few-flowered, linear panicles.—Rocky woods, Massachusetts to Ontario, Minnesota, Texas, Alabama, and Virginia. August, September.

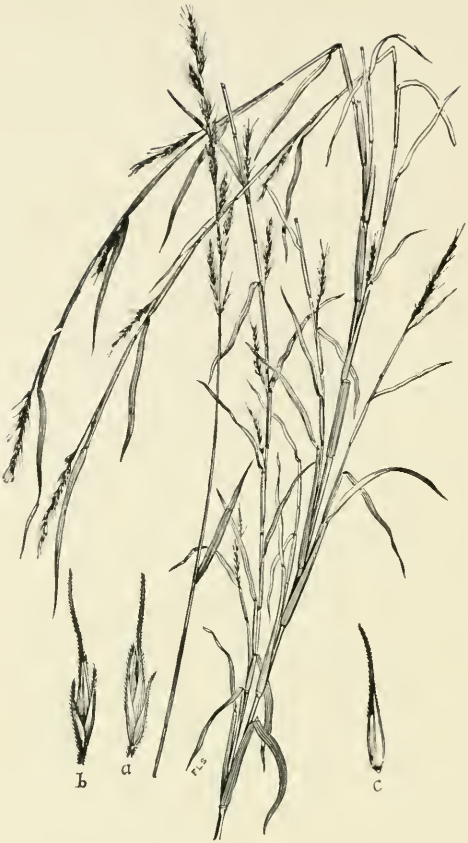


FIG. 102. **Muhlenbergia sylvatica** Torr. WOODLAND DROPSEED.—A perennial, usually much-branched grass 6 to 9 dm. high, with strong, scaly rootstocks, flat leaves and narrow, densely flowered panicles 5 to 15 cm. long.—In rocky woods, and wooded banks of streams, New Brunswick and Ontario to North Carolina, Tennessee, Texas, Kansas, and Minnesota. August–October.

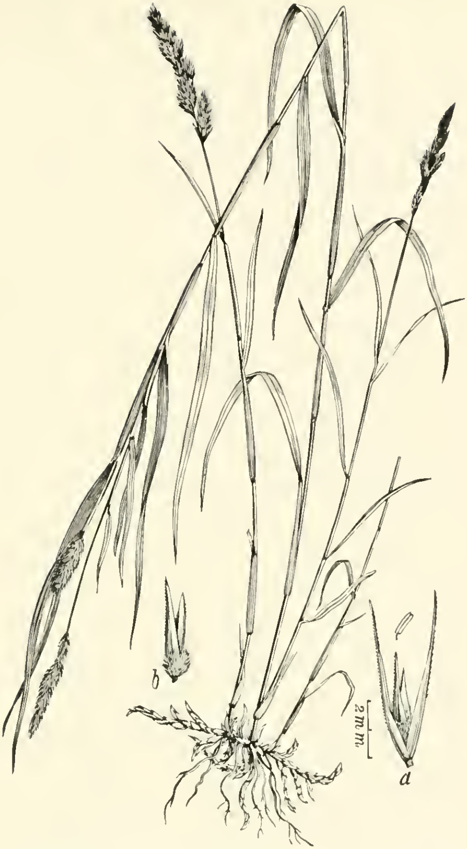


Fig. 103. **Muhlenbergia racemosa** (Michx.) B. S. P.; Britton and Brown Ill. Fl., **1**: 143 (*M. glomerata* Trin.). Wild Timothy.—A rather stout, upright perennial, with very tough and densely scaly rootstocks, nearly simple culms 6 to 9 dm. high, and densely flowered, narrow panicles 5 to 10 cm. long.—Moist meadows and low grounds, Newfoundland to New Jersey, Missouri, Arizona, and British Columbia. June–September.

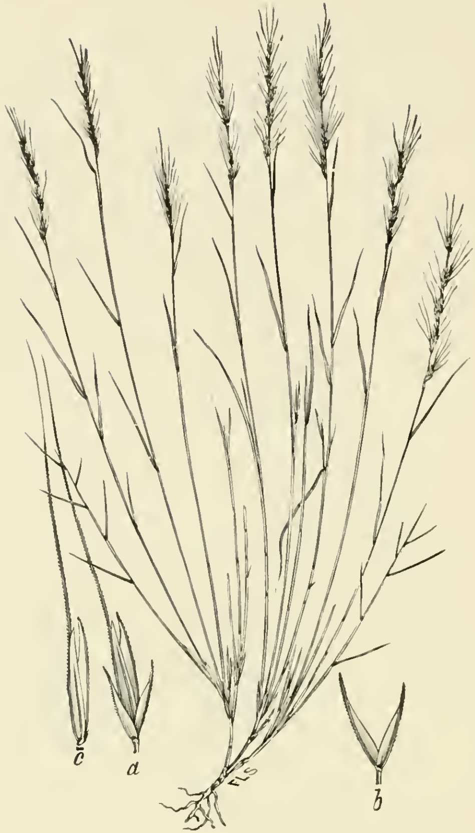


FIG. 104. **Muhlenbergia pringlei** Scribn.; Beal, Grasses N. Am., **2** : 257.—An erect, densely cæspitose, wiry perennial, with simple culms 3 to 4 dm. high, involute-filiform leaves and slender, contracted, often purplish panicles 6 to 10 cm. long.—Canyons, basins, and shaded ledges, mountains of New Mexico and Arizona. [Mexico.] May-September

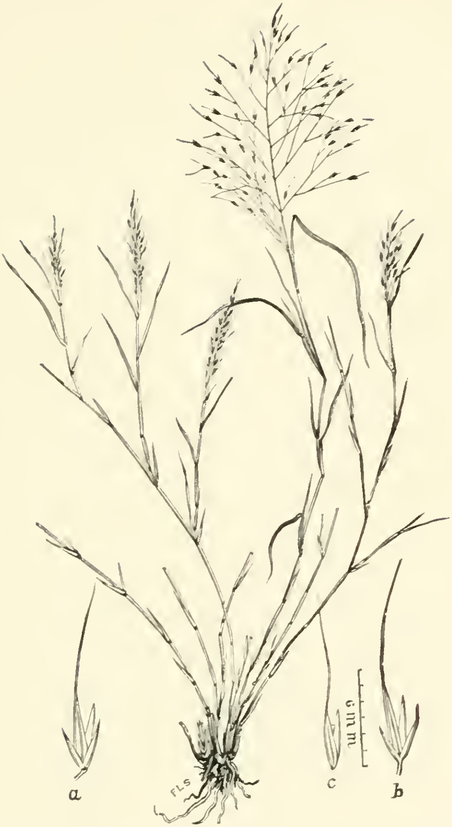


FIG. 105. **Muhlenbergia porteri** Scribn. in Beal. Grasses N. Am., **2** : 259 (*M. texana* Thurb. not Buckley).—A much-branched native perennial, with slender. somewhat wiry stems 3 to 6 dm. long, rather short, narrow leaves, and diffuse panicles. Valuable for grazing and for hay.—Dry mesas and table-lands, Texas to Arizona, Nevada, and California. [Mexico.] August, September.

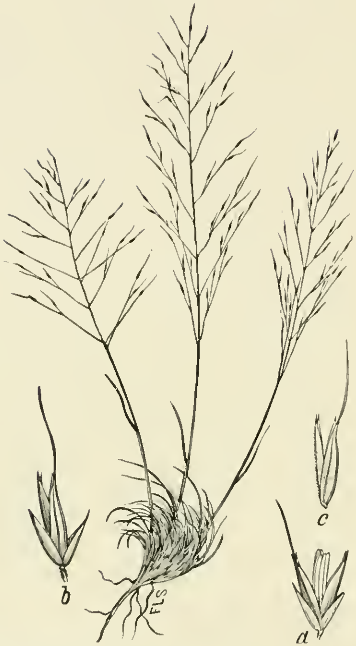


FIG. 106. **Muhlenbergia gracillima** Torr.; Beal, Grasses N. Am., **2**: 261.—A densely tufted perennial, with slender culms 2 to 4 dm. high, numerous involute basal leaves and open capillary panicles 10 to 15 cm. long.—Dry plains, Kansas to Colorado, Texas, and Arizona. July–October.

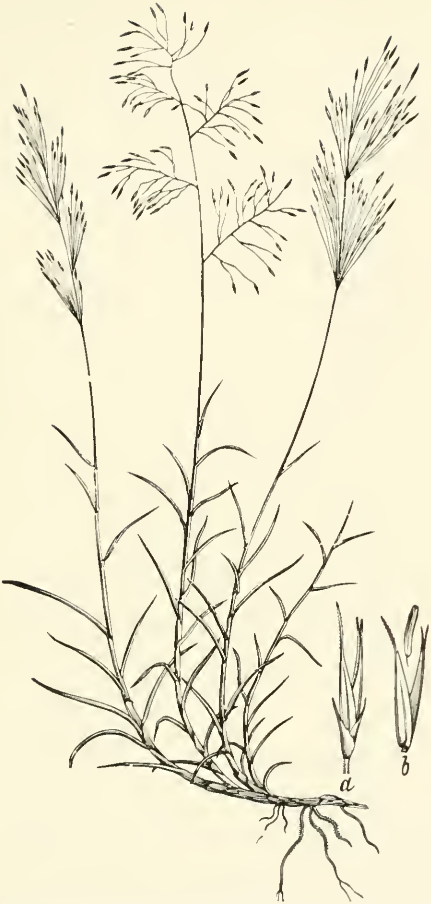


Fig. 107. **Muhlenbergia pungens** Thurb.; Britton and Brown, Ill. Fl., **1**: 146.—A rigid, native perennial 3 to 4.5 dm. high, with firm, sharp-pointed leaves and open panicles about 15 cm. long.—Dry soil, sand hills and plains, Nebraska to Utah, Texas and Arizona. July–October.

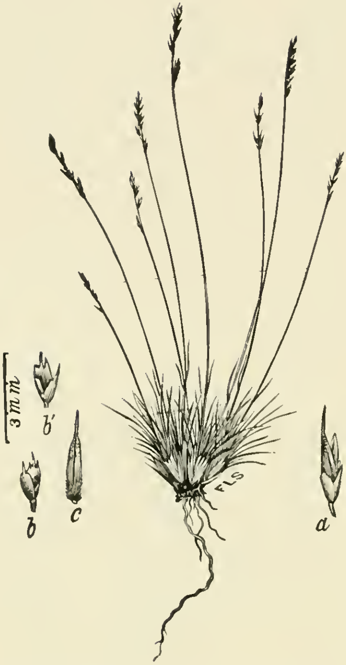


Fig. 108. **Muhlenbergia filiculmis** Vasey; Contrib. U. S. Nat. Herb. **1** : 267; Beal, Grasses N. Am., **2** : 250. THREAD-LIKE MUHLENBERGIA.—A low, tufted perennial with filiform scape-like culms 1.5 to 3.5 dm. high, setaceous radical leaves and narrow, spike-like panicles 2 to 5 cm. long.—Sandy soil, Ute Pass, El Paso County, in moist prairies at Como, Park County, and on the mesas at Twin Lakes, Lake County, Colorado; alt. 2,000 to 3,000 m. July–September.

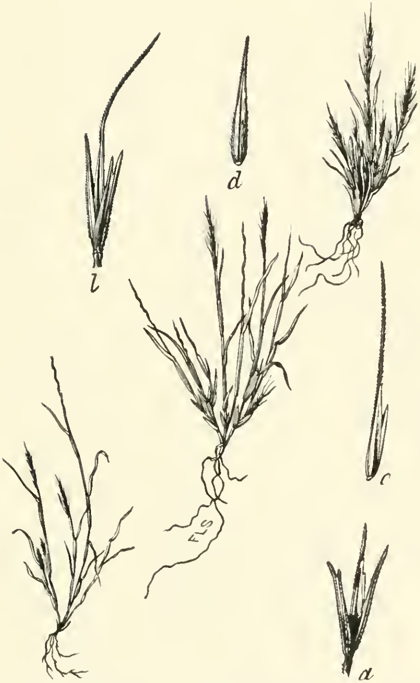


Fig. 109. **Muhlenbergia schaffneri** Fourn; Beal, Grasses N. Am., **2**: 239.—A low, cæspitose, branching annual 2 to 10 cm. high, with short leaves and simple, spike-like panicles. Awn of the flowering glume 1 to 7 lines long.—"Dry, gravelly patches of thin soil," mountains of Arizona and New Mexico. [Mexico.] September.

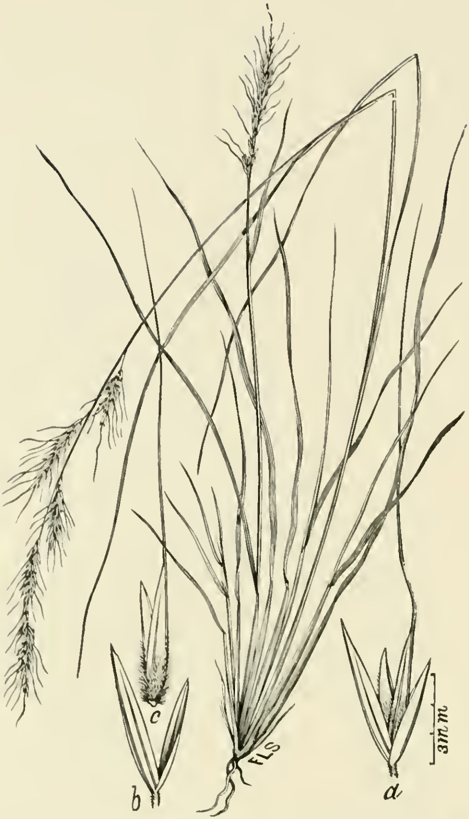


Fig. 110. **Muhlenbergia virescens** (HBK.) Trin.; Beal, Grasses N. Am., **2** : 242.—A rather slender, erect perennial about 6 dm. high, with long, narrow leaves and a strict, pale-green or straw-colored panicle about 15 cm. long.—At an altitude of 1,800 to 2,400 m. on the mountains of Arizona and New Mexico. [Mexico.] May. June.

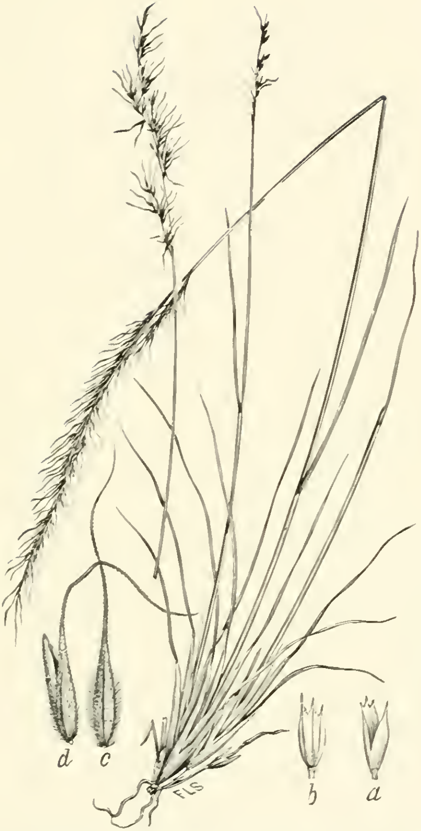


Fig. 111. **Muhlenbergia gracilis** Trin.; Beal, Grasses N. Am., **2**: 242.—A slender, but rather rigid, densely cæspitose perennial 1.5 to 6 dm. high, with narrow, involute leaves, and contracted panicles 8 to 15 cm. long.—Ascending to 2.700 m. or more Texas to Arizona, Colorado, and Wyoming. [Mexico.] June-September.

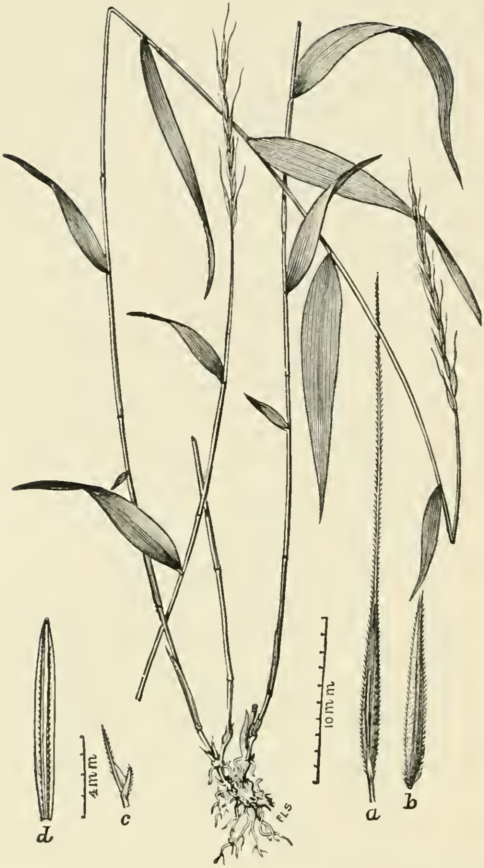


FIG. 112. **Brachyelytrum erectum** (Schreb.) Beauv. (*B. aristatum* R. & S.). BEARDED SHORT-HUSK.—A perennial, with simple culms 3 to 9 dm. high, flat, spreading leaf blades and few-flowered, simple, terminal panicles.—Open, rocky woods, Newfoundland to North Carolina, Alabama, Missouri, and Minnesota and Ontario. May–August.

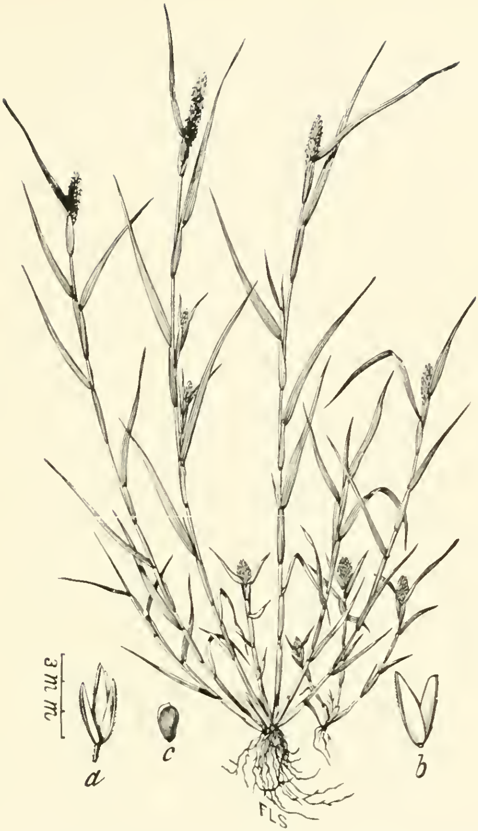


Fig. 113. **Heleochloa schœnoides** (L.) Host (*Phleum schœnoides* L.; *Crypsis schœnoides* Lam.). Rush-like Timothy.—A diffusely branching cæspitose annual 1 to 3 dm. high, with inflated sheaths, rather short, spreading leaves, and densely flowered ovate, or oblong, spike-like panicles.—Waste ground about New York City, Philadelphia, etc., sparingly naturalized. [Europe and Asia.] July, August.

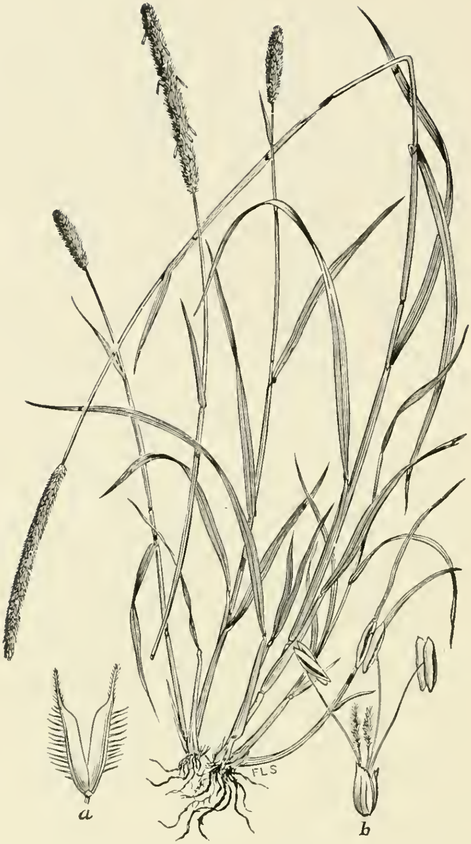


Fig. 114. **Phleum pratense** L. Timothy.—A perennial with erect, simple culms 3 to 12 dm. high and dense, cylindrical, spike-like panicles 2.5 to 10 cm. long.—Widely cultivated and completely naturalized in fields, waysides, and waste ground throughout the United States and British America. [Europe and Asia.] June–August.

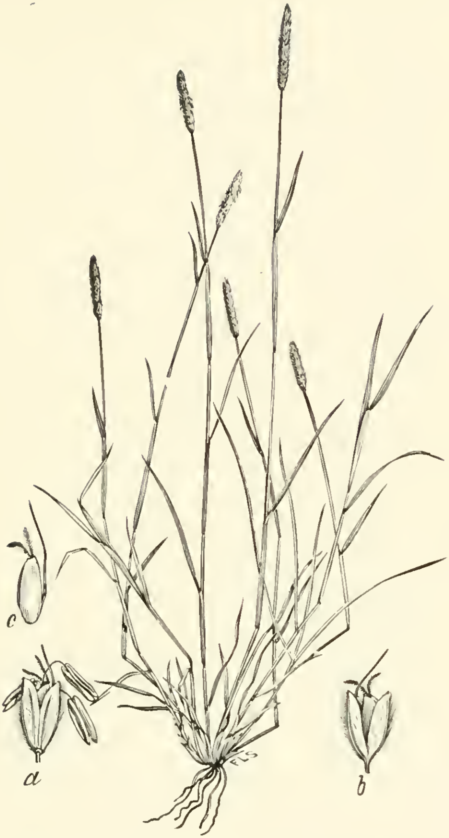


Fig. 115. **Alopecurus geniculatus** L. Floating Foxtail.—A slender perennial, with culms decumbent and branched at base, then erect or ascending, 1.5 to 6 dm. high, flat, spreading leaves and dense, spike-like, slender panicles 2.5 to 7.5 cm. long.—Wet meadows, banks of streams and ditches throughout the United States, and from Newfoundland to British Columbia. [Europe and Asia.] April–September.

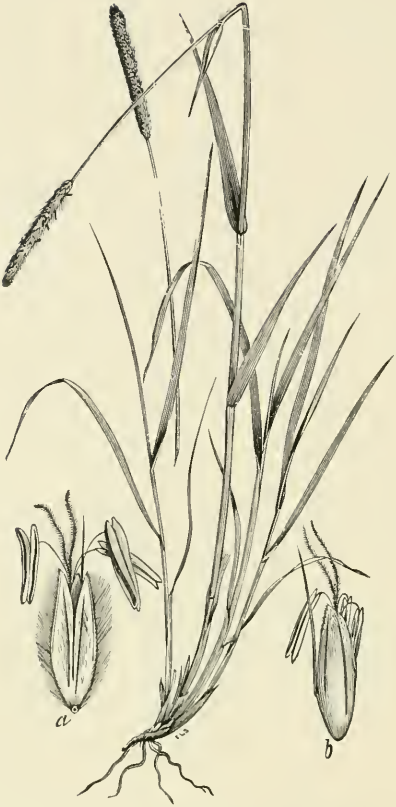


FIG. 116. **Alopecurus pratensis** L. MEADOW FOXTAIL.—An erect, smooth perennial 3 to 9 dm. high, with short, creeping rootstocks, flat, spreading leaf blades, and dense, cylindrical, spike-like panicles 5 to 10 cm. long.—Naturalized in fields and meadows, Labrador to southern New York, Ohio and Michigan; also Oregon, Idaho, and California. [Europe, Asia, and Africa.] June, July.

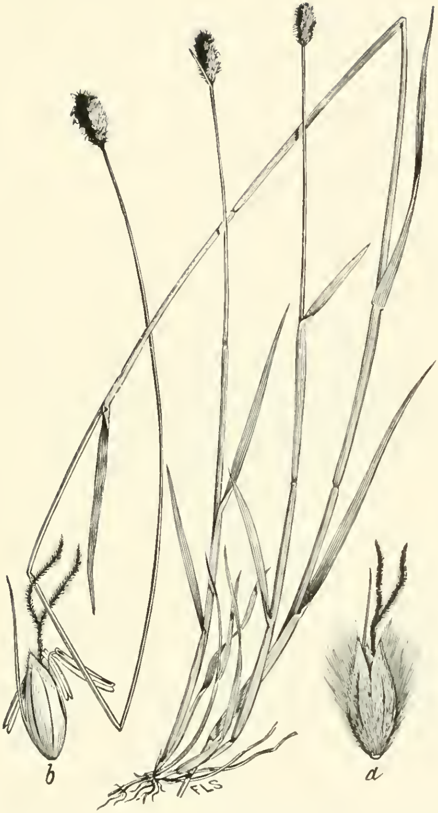


FIG. 117. **Alopecurus occidentalis** Scribn. (*A. pratensis alpestris* A. Gray). MOUNTAIN FOXTAIL.—An erect, rather slender grass 6 to 9 dm. high, with shorter and thicker heads than those of Meadow Foxtail.—Wet meadows and banks of streams, high mountains of Montana, Idaho, Wyoming, and Colorado. June–September. A valuable hay grass.

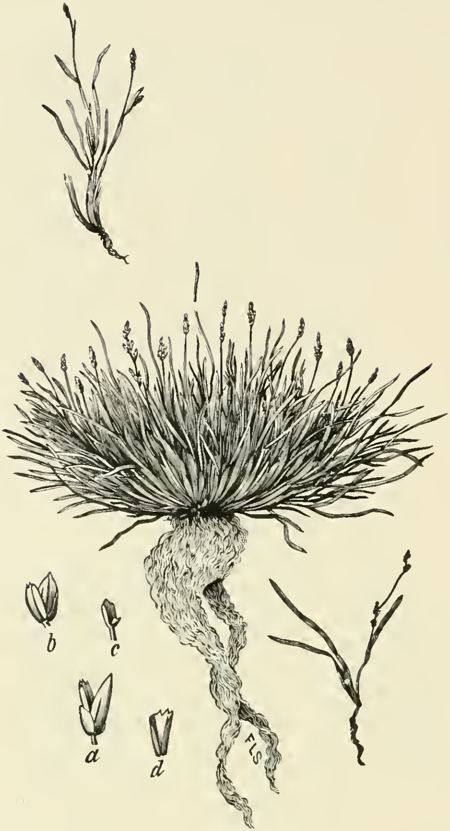


Fig. 118. **Phippsia algida** (Soland.) R. Br.; Britton and Brown, Ill. Fl., **1**: 150. Phippsia.—A low, tufted, glabrous perennial 2 to 10 cm. high, with narrow, soft, and flat leaves and contracted, simple panicles.—Arctic North America and on the highest mountain peaks of Colorado. [Greenland, arctic Europe, and Asia.] July, August.

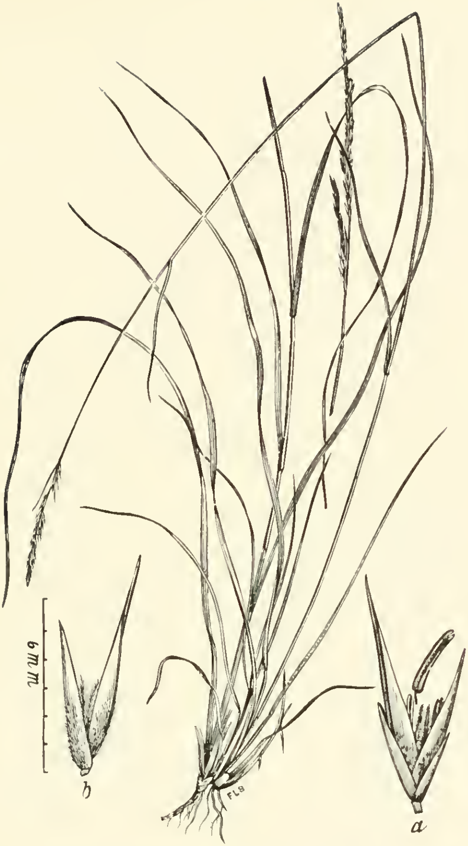


Fig. 119. **Sporobolus asper** (Michx.) Kunth (*Agrostis asper* Michx.). Prairie-grass.—A rather slender perennial 3 to 9 dm. high, with usually long, involute-filiform leaf blades and contracted, linear panicles 5 to 15 cm. long.—In dry, sandy soil, open woods and glades, Long Island to Florida, west to Texas, Missouri, and Illinois. August-October. Avoided by stock excepting when young.

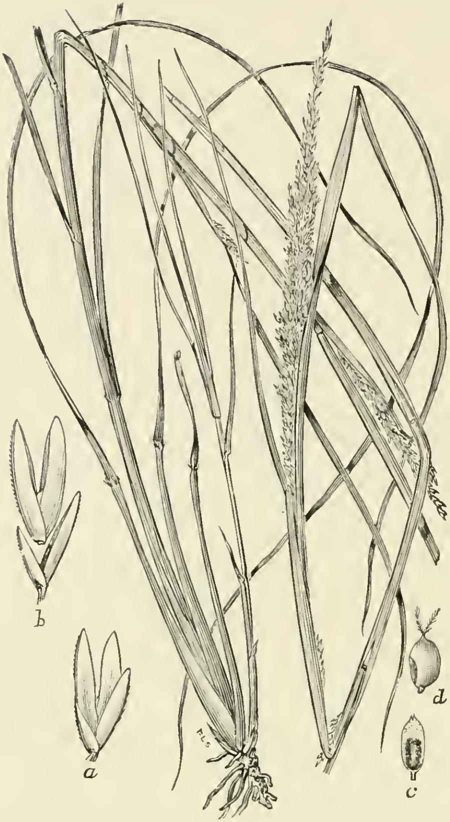


Fig. 120. **Sporobolus longifolius** (Torr.) Wood; Britton and Brown, Ill. Fl., **1**: 151. Long-leafed Sporobolus.—A stout perennial 3.5 to 10 dm. high, with very long, attenuate-pointed leaves, and strict, spike-like panicles 3 to 10 inches long, which are more or less included in the inflated leaf sheaths.—Dry, sandy soil, Maine to Pennsylvania, South Dakota and Utah, south to Texas and Florida. August–October.

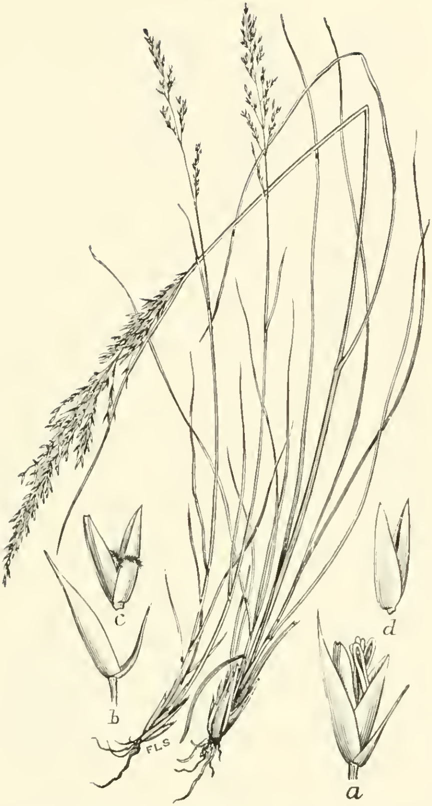


FIG. 121. **Sporobolus heterolepis** A. Gray. STRONG-SCENTED SPOROBOLUS.—A rather stout, somewhat wiry, cæspitose perennial 6 to 9 dm. high, with very long basal leaves and loose, open panicles.—In dry soil, prairies, etc., Connecticut to Quebec, Iowa and Nebraska and Wyoming, thence south to Texas and north to Assiniboia and Saskatchewan. August, September.

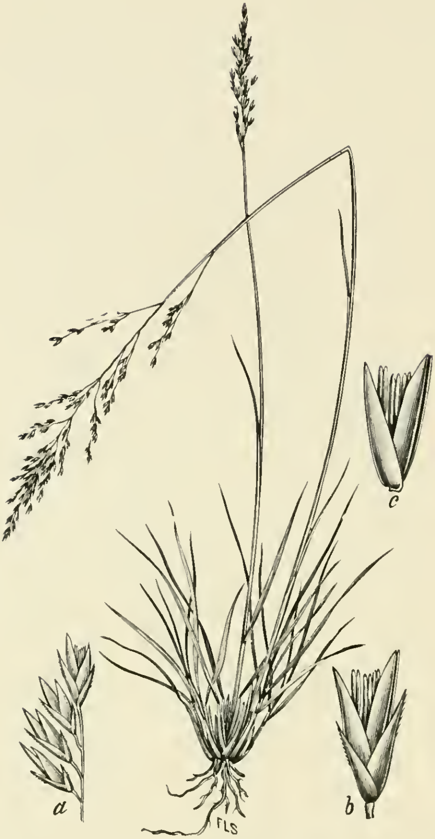


Fig. 122. **Sporobolus interruptus** Vasey; Beal, Grasses N. Am., **2** : 286.—A rather stout, erect perennial with simple culms about 4 dm. high, flat leaves and narrow but loosely flowered panicles 10 to 18 cm. long.—In forests, mountains of Arizona. August, September.

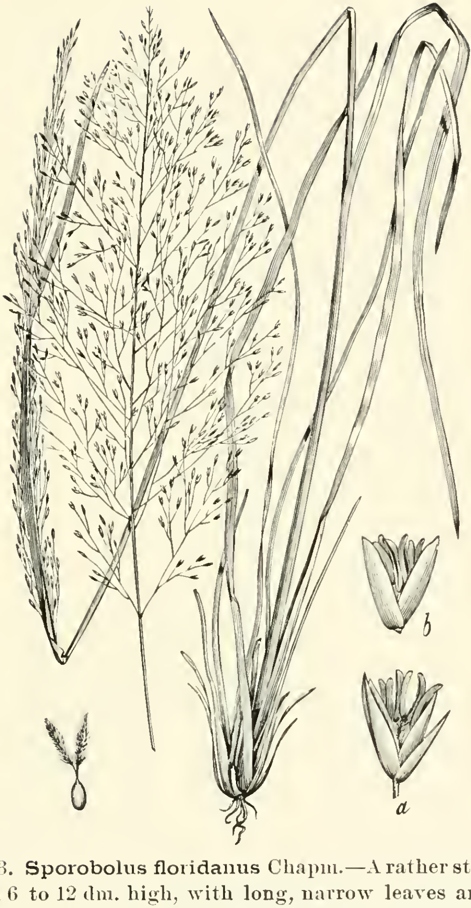


Fig. 123. **Sporobolus floridanus** Chapm.—A rather stout, erect perennial 6 to 12 dm. high, with long, narrow leaves and diffuse panicles 2.5 to 5 cm. long. Pedicels capillary; spikelets purplish.—Moist pine barrens near the coast, North Carolina to western Florida. July–September.

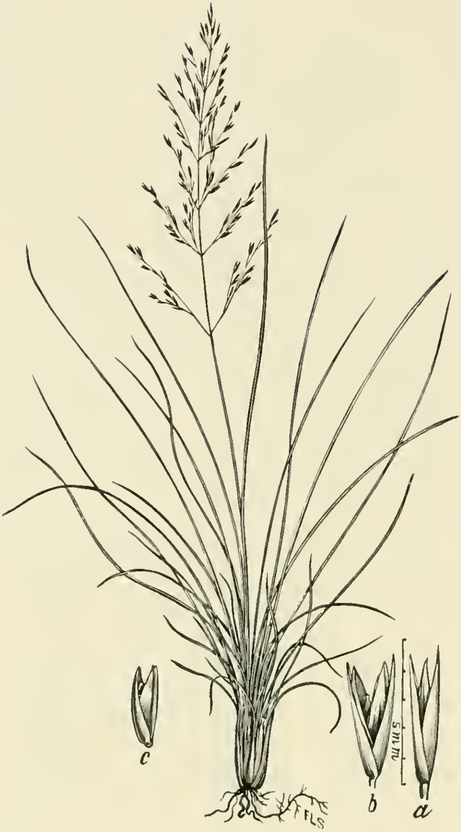


FIG. 124. **Sporobolus curtissii** (Vasey) Small. (*S. floridanus curtissii* Vasey; Beal, Grasses N. Am., **2** : 290).—A wiry, erect perennial 3 to 6 dm. high, with very long leaves and loosely flowered, open panicles 15 to 25 cm. long.—Moist pine barrens, northeastern Florida. July–November.

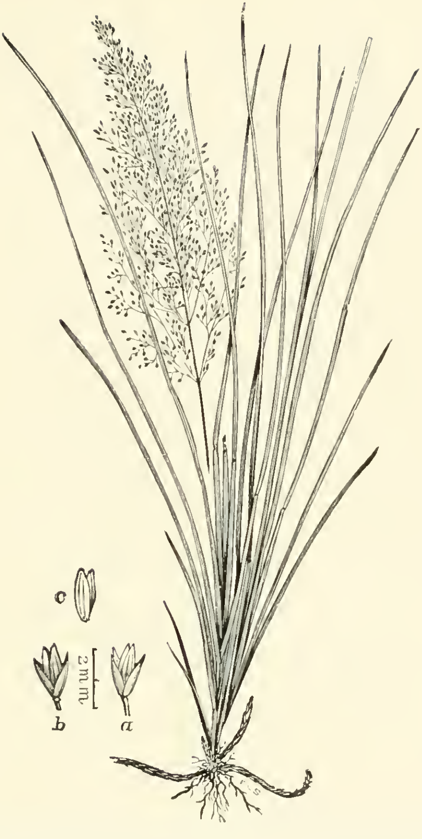


FIG. 125. **Sporobolus compressus** (Torr.) Kunth. (*Agrostis compressa* Torr.). FLAT-STEMMED SPOROBOLUS.—A cæspitose perennial, with short, scaly rootstocks, flattened culms 3 to 6 dm. high, rather long, conduplicate leaves and open, capillary panicles 10 to 30 cm. long.—In bogs and pine barrens, Long Island and New Jersey. September, October.

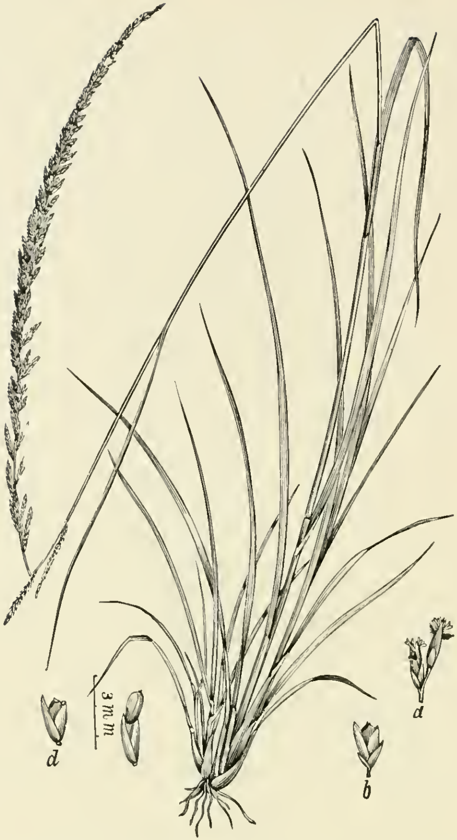


FIG. 126. **Sporobolus indicus** (L.) R. Br. SMUT-GRASS.—A tufted, wiry, erect perennial 3 to 9 dm. high, with simple culms and narrow, densely flowered, spike-like panicles 10 to 30 cm. long.—Abundantly naturalized in waste ground, waysides, fields, and pastures. Virginia and Tennessee to Florida, Arkansas, Texas, and California; occasional in the Eastern cities. [Native or naturalized in all tropical countries.] March–September.

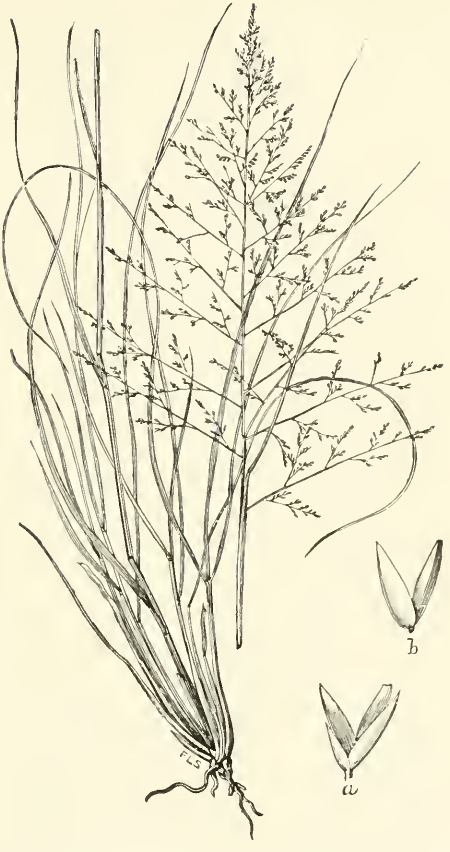


FIG. 127. **Sporobolus airoides** Torr. FINE-TOP SALT-GRASS.—A stout, coarse, and rigid perennial 3 to 9 dm. high, with long, narrow leaves and open, spreading panicles of many small spikelets.—Moist or dry, usually saline or alkaline soil in deserts, prairies, along streams, in meadows, etc., Nebraska and Kansas to Idaho, California, Texas, and Arizona. [Mexico and Lower California.] July–September.

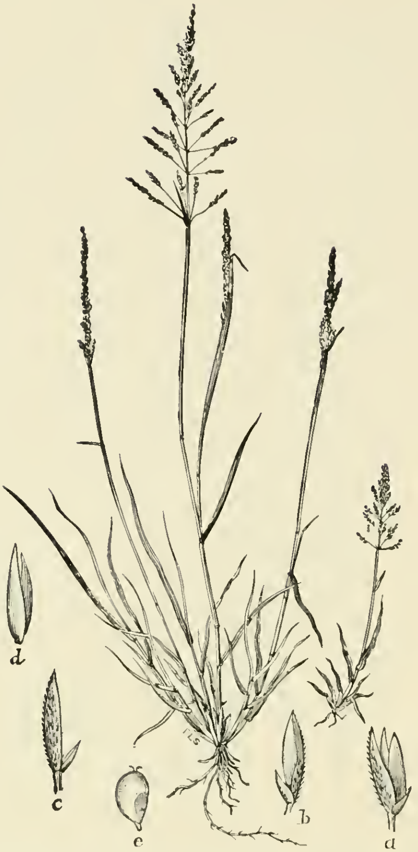


FIG. 128. **Sporobolus argutus** (Nees) Kunth (*Vilfa arguta* Nees.); Beal, Grasses N. Am., **2** : 301.—A cæspitose perennial 2 to 4 dm. high, with flat leaves and open (at first strict) panicles 3 to 5 cm. long.—"Sand dunes and sandy flats near river banks," Kansas and Colorado to Texas and western Louisiana, also in southern Florida. [Mexico and West Indies.] May–September.

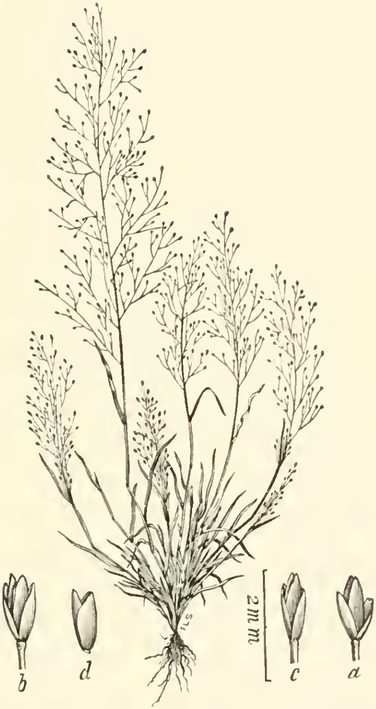


FIG. 129. **Sporobolus confusus** (Fourn.) Vasey; Beal, Grasses N. Am., **2** : 294.—A slender, branching, tufted annual 0.8 to 2 dm. high, with loose sheaths, flat leaves, and capillary, ovoid or oblong panicles 8 to 15 cm. long.—Sandy banks of streams, moist places in sandy plains, canyons, etc., Texas to California, and in Colorado and Montana. [Mexico.] July–September.

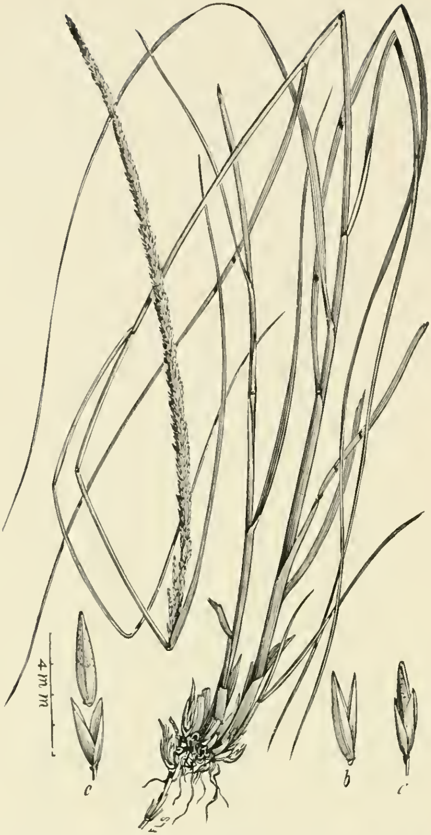


FIG. 130. **Epicampes rigens** (Boland.); Benth.; Beal, Grasses N. Am., **2**: — (*Cinna macroura* Thurb. not Kunth; *Vilfa rigens* Boland. not Trin.). DEER-GRASS.—A stout, erect perennial, with rigid, wiry culms 9 to 12 dm. high; long, narrow leaves and very long, narrow, and densely flowered spike-like panicles.—In the foothills, Texas to Nevada, New Mexico, Arizona, and southern California. [Mexico.] July–November. A bunch-grass of some agricultural value.

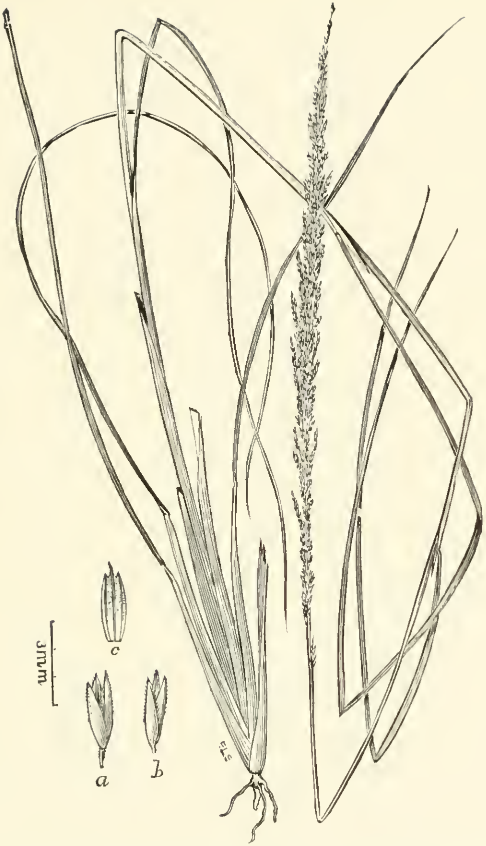


FIG. 131. **Epicampes ligulata** Scribn. sp. nov.—A stout, rigid perennial 6 to 12 dm. high, with narrow, very scabrous leaves and strict, rather densely flowered panicles 20 to 40 cm. long. Leaves long-attenuate pointed, rigid, and subinvolute at the base, where they are much narrower than the rigid ligule, which is 10 to 30 mm. long. Spikelets dark purple, glumes subequal.—Cool slopes and canyons, mountains of New Mexico and Arizona. [Mexico.] August, September.

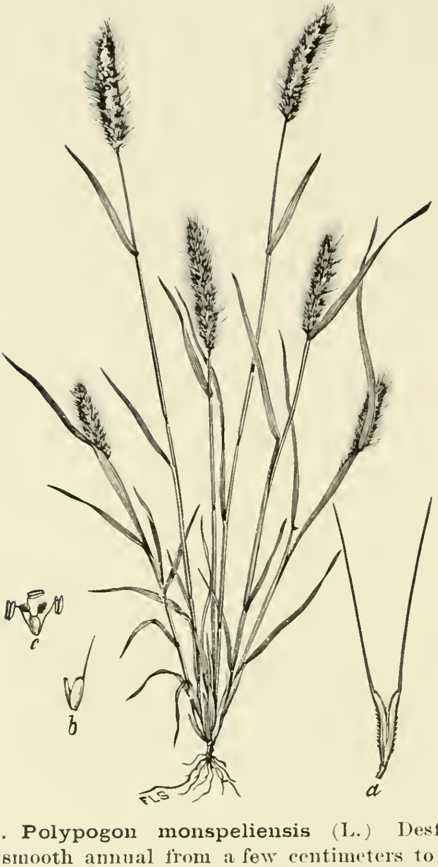


FIG. 132. **Polypogon monspeliensis** (L.) Desf. BEARD-GRASS.—A smooth annual from a few centimeters to 6 to 9 dm. high, with awned 1-flowered spikelets crowded in dense spike-like panicles.—In fields and waste places, sparingly naturalized along the Atlantic Coast from New Hampshire to South Carolina; abundantly on the Pacific Slope from California to Vancouver Island, and in Arizona, Nevada, and Colorado. [Europe and Asia.] April–October.

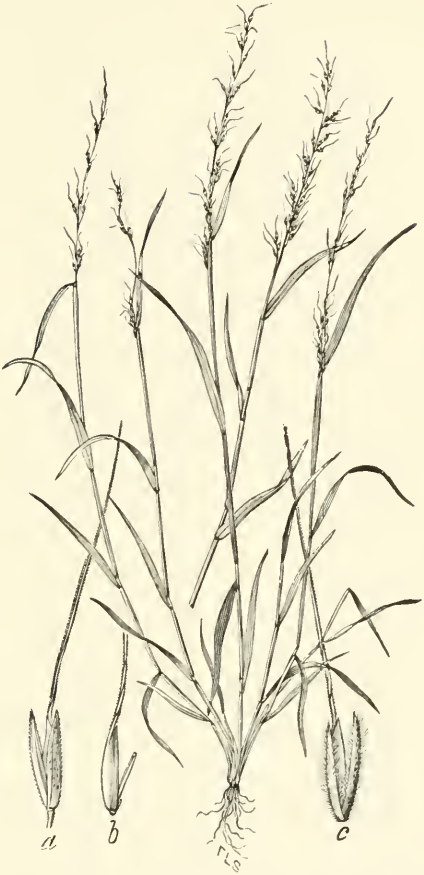


Fig. 133. **Limnodia arkansana** (Nutt.); Dewey in Contrib. U. S. Nat. Herb., **2**: 518 (*Greenia arkansana* Nutt.; *Thurberia arkansana* Benth.).—A slender annual 2 to 6 dm. high, more or less geniculate at the lower nodes, with soft, flat leaves and narrow, loosely flowered panicles 8 to 18 cm. long. Outer glumes scabrous or pilose.—Shell banks, woods, etc., western Florida to Arkansas and southern Texas. April–June.

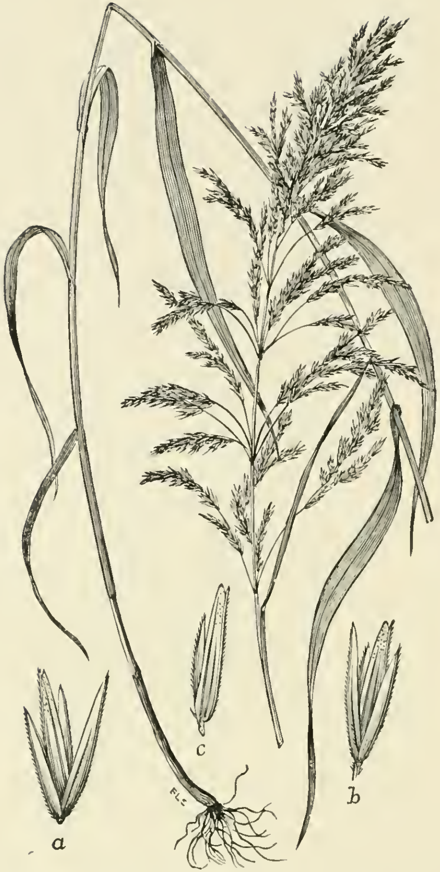


FIG. 134. **Cinna arundinacea** L. INDIAN REED.—A tall, leafy grass 9 to 21 dm. high, with simple culms, flat leaf blades, and ample terminal panicles.—Shaded swamps, banks of streams and low thickets, Newfoundland to North Carolina, Alabama, Texas, South Dakota, and the Northwest Territory. May-September.

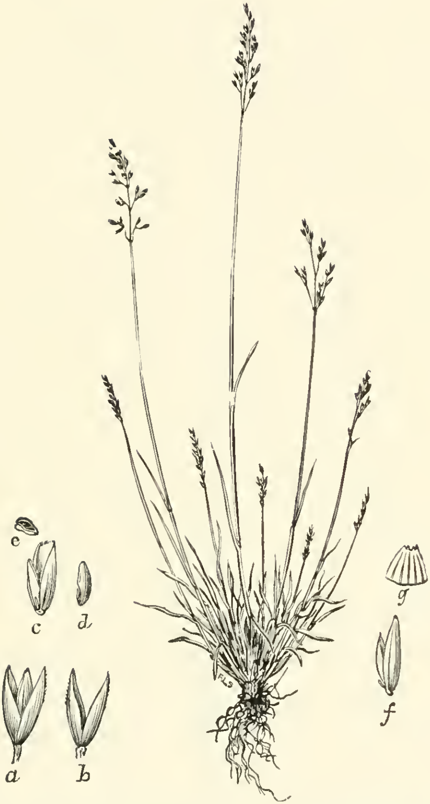


FIG. 135. **Agrostis humilis** Vasey (*A. varians* Trin.? not Thuill.). —A dwarf, slender perennial 6 to 12 cm. high, with short, flat leaves and contracted, purplish panicles 2 to 3 cm. long.—Moist meadows, or mossy and springy places, at 2,100 to 3,000 m. altitude on the mountains of Colorado, Wyoming, Washington, Oregon, and Montana. August, September.

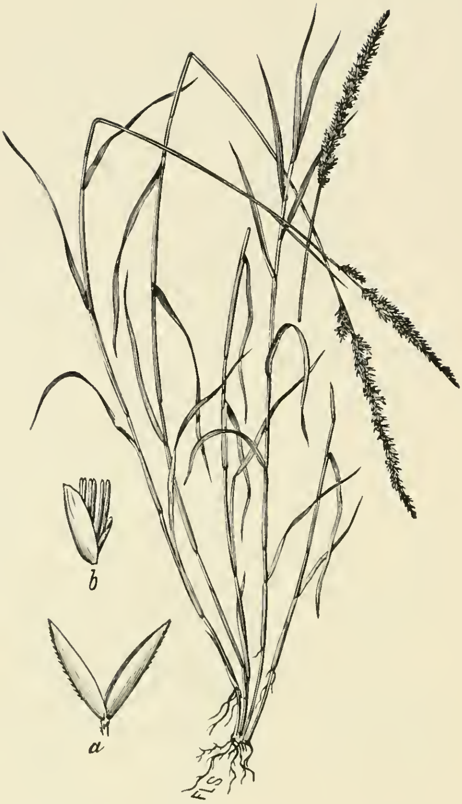


Fig. 136. **Agrostis coarctata** Ehrh. (*Stolonifera coarctata* Reichb).—A creeping perennial with slender culms, the upright branches about 3 dm. high, short, flat leaves and narrow, rather densely flowered panicles 5 to 10 cm. long.—Damp soil and sands along the coast, Newfoundland to New Jersey. [Europe.] July–October. A fine-leafed, excellent turf-forming species, valuable for lawns.

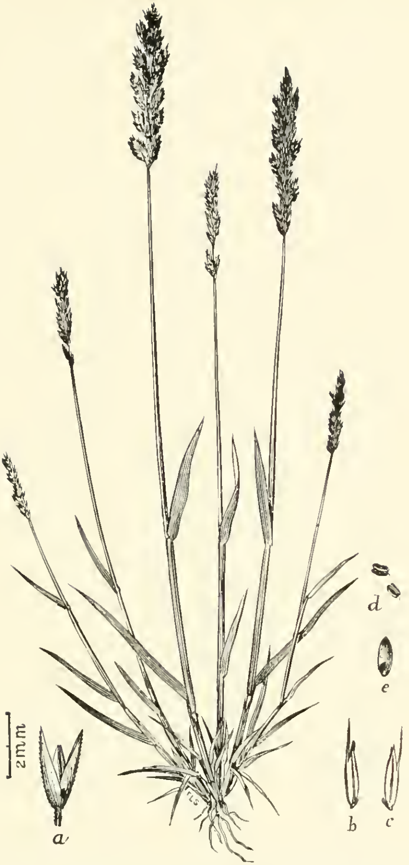


FIG. 137. **Agrostis densiflora** Vasey; Contrib. U. S. Nat. Herb., **3**: 72 (1892); Beal, Grasses N. Am., **2**: 326. DENSELY-FLOWERED BENT.—A rather stout, cæspitose perennial 1.5 to 4.5 dm. high, with short and comparatively broad leaves and densely, many-flowered, almost spike like panicles 3 to 8 cm. long.—Oregon and California, along the coast, apparently rare. July, August.

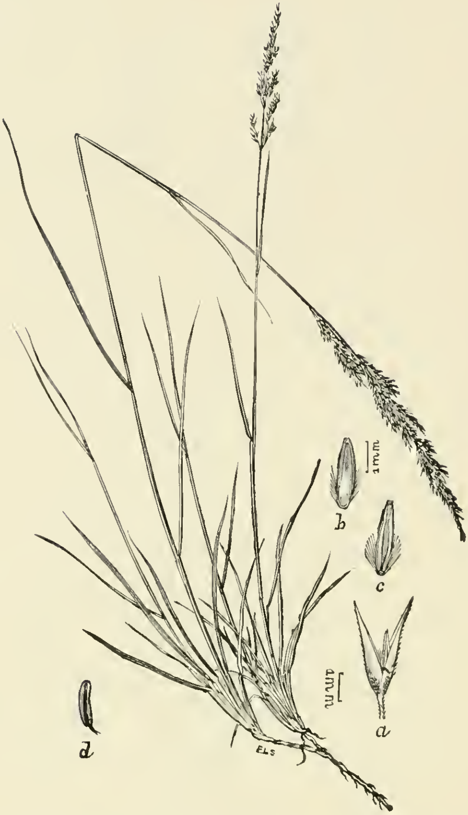


FIG. 138. **Agrostis pringlei** Scribn. sp. nov.—A strongly stoloniferous grass, with rather slender, upright or ascending culms 3 to 6 dm. high, narrow and rather rigid flat leaves, and loosely flowered, narrow panicles 5 to 15 cm. long. Flowering glumes much shorter than the acuminate outer ones, and remarkable for the long hairs on the callus.—Plains, Mendocino County, California (Pringle), and northward to Oregon (?). August.

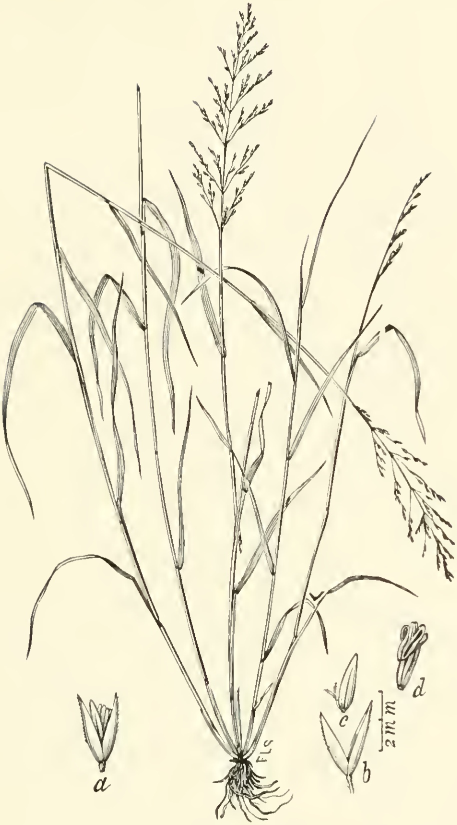


Fig. 139. **Agrostis diegoensis** Vasey (*A. foliosa* Vasey); Beal, Grasses N. Am., **2** : 328.—A strong-growing, leafy perennial 6 to 10 dm. high, from creeping rootstocks, with pale-green, narrow, and many-flowered panicles 15 to 20 cm. long. Spikelets 2 to 3 mm. long; flowering glume short-awned or awnless; palea wanting.—Mountains of southern California to Washington. May–August.

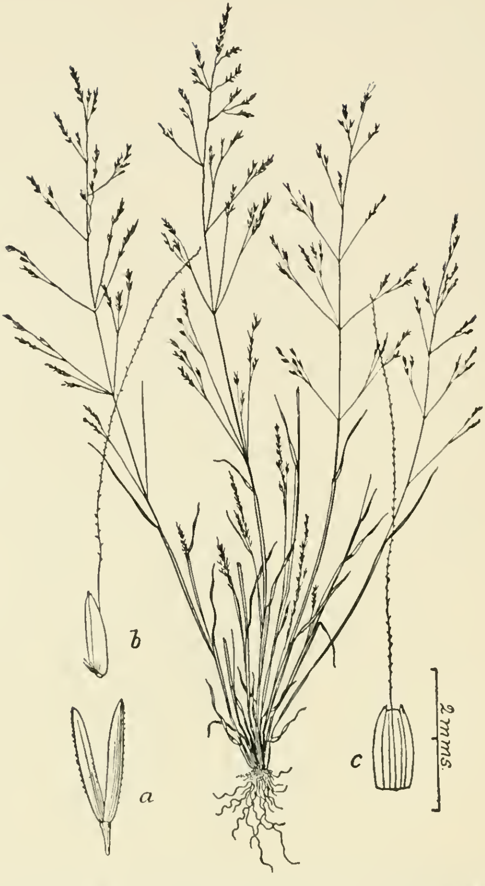


FIG. 140. **Agrostis elliottiana** Schult. (*A. arachnoides* Ell.). SPIDER BENT-GRASS.—A low, branching annual, rarely exceeding 3 dm. high, with narrow, flat leaves and diffuse, capillary panicles. The flowering glume bears a long and very slender awn.—Dry hillsides and old fields, South Carolina to Kentucky and Missouri, south to Florida and Texas. April, May.

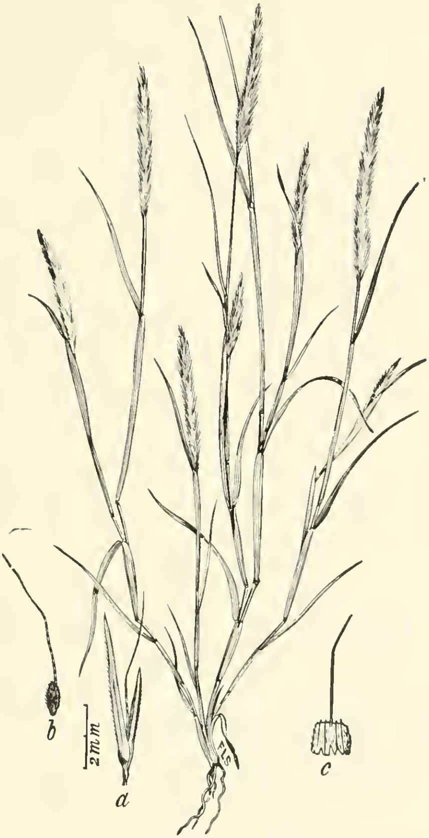


FIG. 141. **Gastridium lendigerum** (L.) Gaudin. (*G. australe* Beauv.; *Milium lendigerum* Linn.). NIT-GRASS.—A smooth annual 1.5 to 6 dm. high, with flat leaves and a strict, spike-like panicle 6 to 12 cm. long; cultivated for ornament.—Hills, naturalized, California and Oregon; also in Texas. [Southern Europe.] June, July.

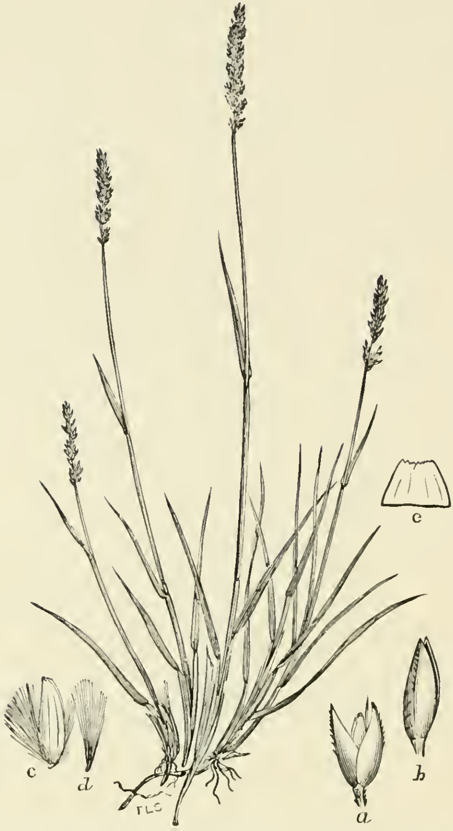


Fig. 142. **Calamagrostis crassiglumis** Thurb.; Beal, Grasses N. Am., **2** : 353 (as a var. of *C. neglecta*).—A rigid, erect perennial 1.5 to 4 dm. high, from creeping rootstocks, with long basal leaves and dense, oblong, spike-like panicles 4 to 6 cm. long.—Wet ground and gravelly lake shores, California to Vancouver Island. July, August.

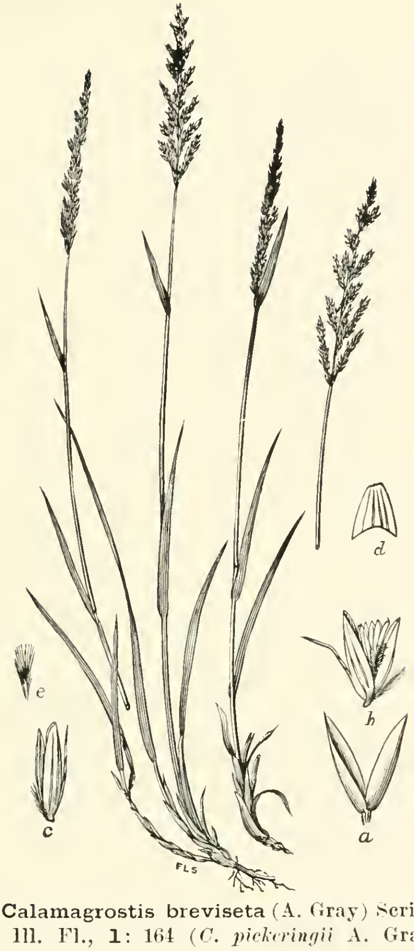


FIG. 143. **Calamagrostis breviseta** (A. Gray) Scribn.; Britton and Brown Ill. Fl., **1**: 164 (*C. pickeringii* A. Gray). SHORT-AWNED REED-GRASS.—A slender perennial 3 to 5 dm. high, with flat leaves and narrow or subpyramidal, rather densely flowered purplish panicles 8 to 12 cm. long.—Moist ground, Newfoundland, Cape Breton Island, and Labrador to New Hampshire, Vermont, and Massachusetts. July, August.

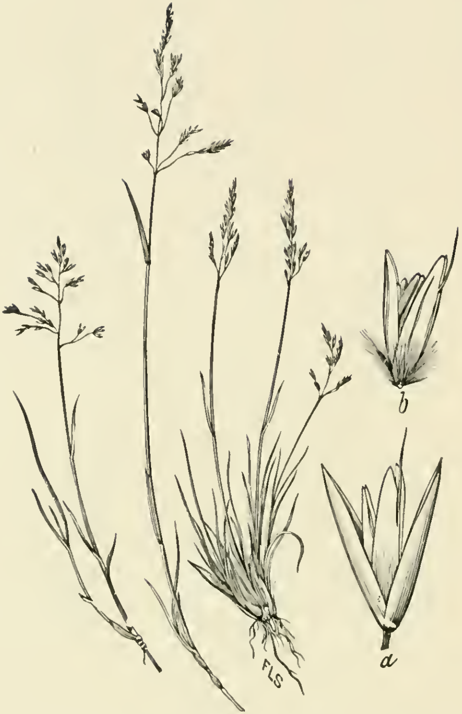


Fig. 144. **Calamagrostis deschampsioides** Trin.; Beal, Grasses N. Am., **2**: 339.—A slender perennial with culms 1.5 to 3 dm. high, from creeping rootstocks, with narrow leaves 3 to 7 cm. long and open, pyramidal panicles 4 to 8 cm. long.—Pribilof Islands, Alaska, southward to California. [Kamchatka.] August.

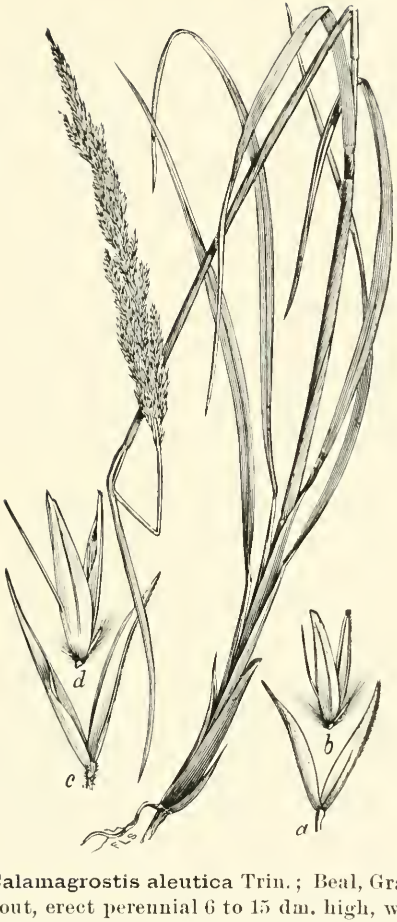


FIG. 145. **Calamagrostis aleutica** Trin.; Beal, Grasses N. Am., **2**: 346.—A stout, erect perennial 6 to 15 dm. high, with long and rather stiff, flat leaves and densely many-flowered, narrow panicles 15 to 30 cm. long.—Along the seashore, in rocky or marshy places, Alaska and Unalaska to California. June–September.

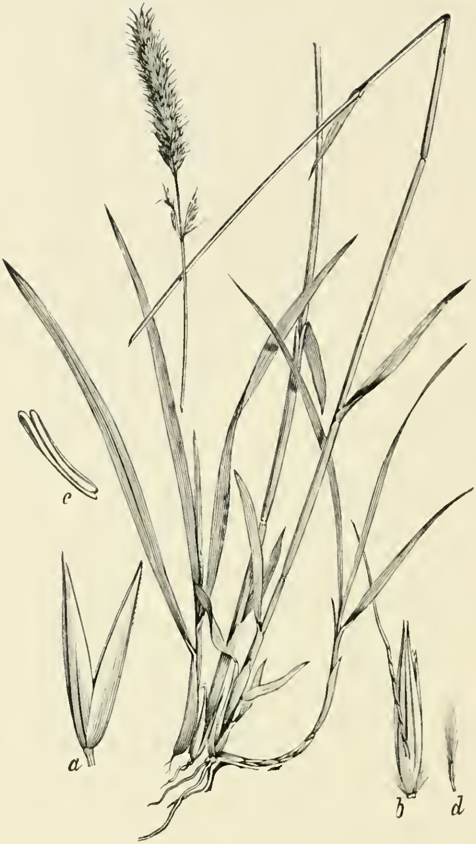


FIG. 146. **Calamagrostis tweedyi** Scribn.; Beal, Grasses N. Am., **2**: 348.—A stout perennial 7 to 10 dm. high, with rather broad, flat leaves and densely flowered, spike-like panicles 8 to 12 cm. long.—Cascade Mountains, Washington.

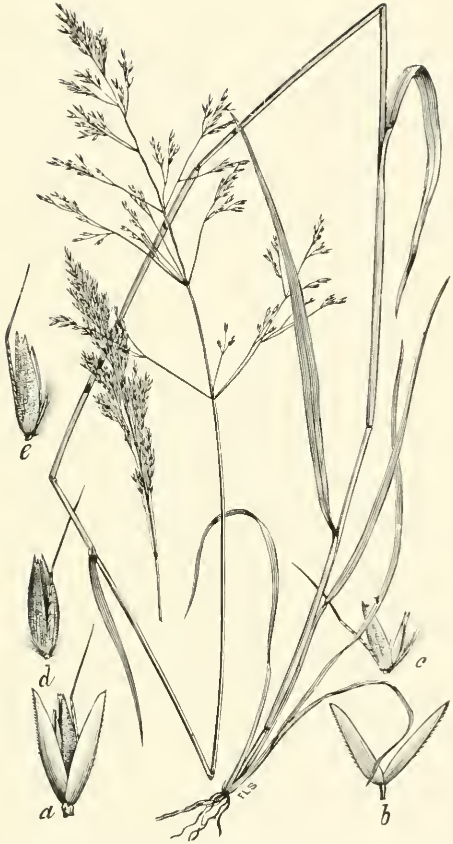


FIG. 147. **Calamagrostis bolanderi** Thurb.; Beal, Grasses N. Am., **2** : 352.—A stout perennial 6 to 15 dm. high, with flat leaves 10 to 30 cm. long and expanded, dark-purple panicles 8 to 20 cm. long.—Moist woodlands, northwestern California. August.

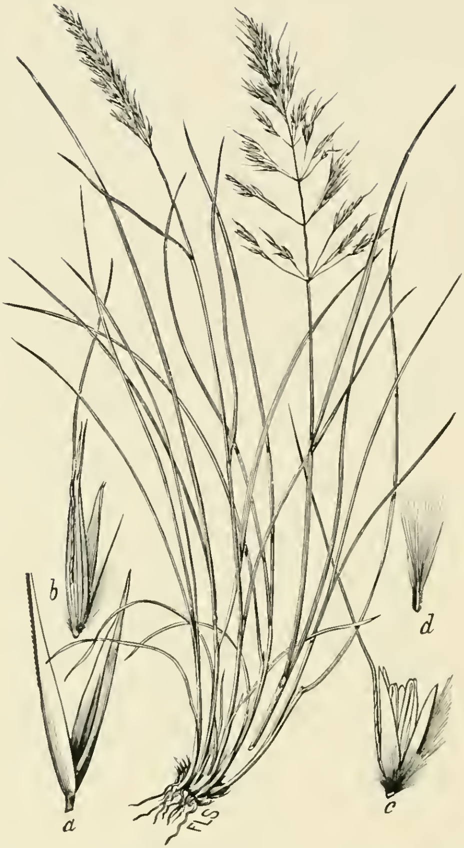


Fig. 148. **Calamagrostis howellii** Vasey; Beal, Grasses N. Am., **2**: 339.—A densely cæspitose, erect, leafy perennial 2.5 to 5 dm. high, with long and narrow basal leaves and open panicles 8 to 15 cm. long. Spikelets long-awned.—High mountains, Oregon and Washington. June–August.

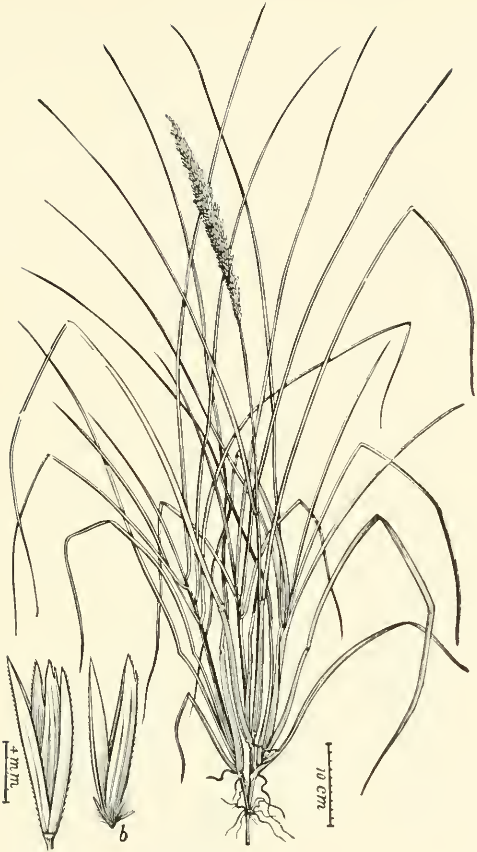


FIG. 149. **Ammophila arenaria** (L.) Link (*A. arundinacea* Host.). BEACH-GRASS, MARRAM-GRASS.—A coarse, erect perennial, with creeping rootstocks, rigid culms 6 to 12 dm. high, long leaves, and narrow, densely flowered, spike-like terminal panicles 12 to 25 cm. long.—Sandy coasts of the Atlantic from New Brunswick south to Virginia, and shores of the Great Lakes. [Europe.] July–October.

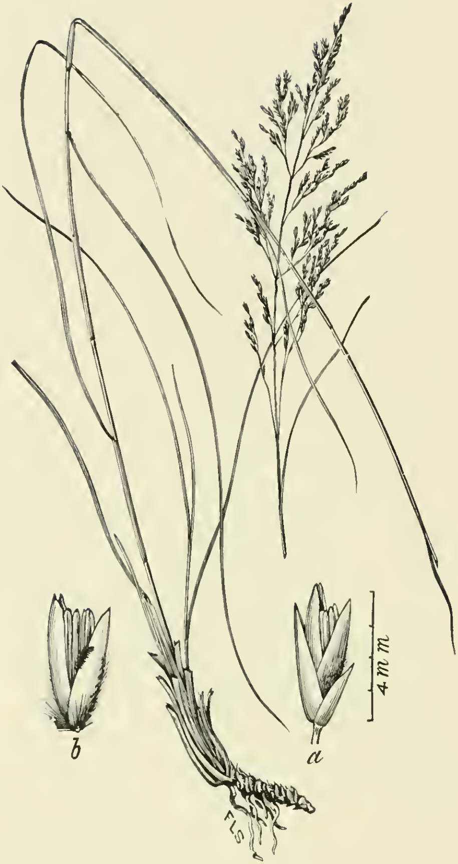


FIG. 150. **Calamovilfa brevipilis** (Torr.) Scribn. (*Arundo brevipilis* Torr.). SHORT-HAIRED REED-GRASS.—A rather slender, smooth perennial 9 to 12 dm. high, with very narrow leaves and open panicles 8 to 24 cm. long.—Sandy swamps in the pine barrens of New Jersey. August, September.

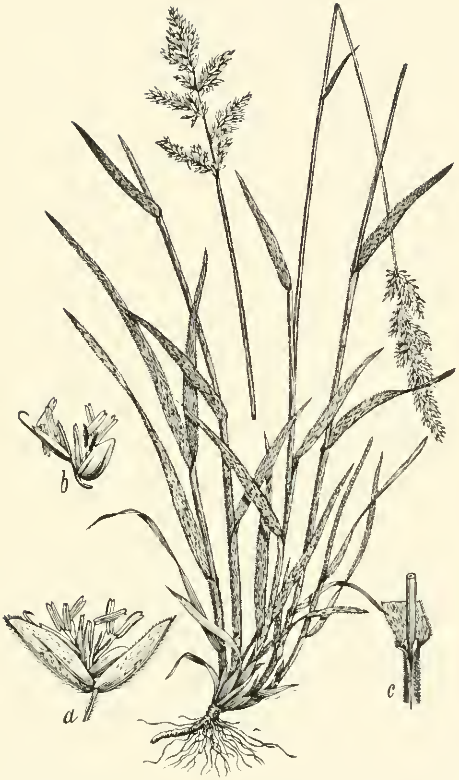


FIG. 151. **Holcus lanatus** L. VELVET GRASS.—A perennial 3 to 6 dm. high, with creeping rootstocks, flat leaves, and open panicles 5 to 8 cm. long; usually densely pubescent all over with soft, whitish hairs.—Introduced into this country from Europe with other grasses and now widely distributed. May–August.

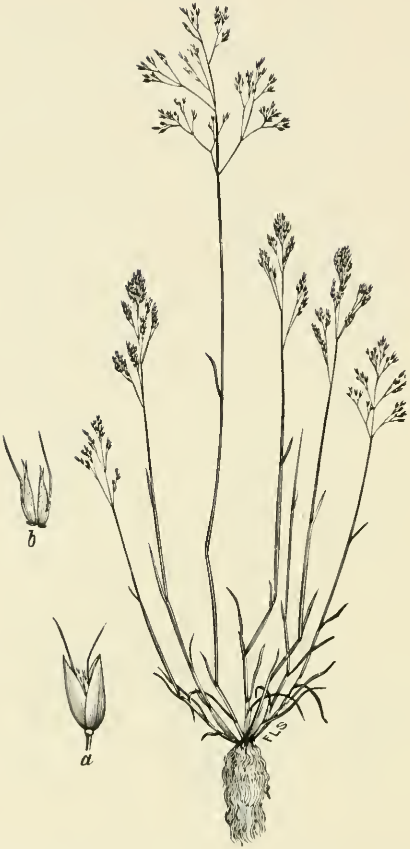


Fig. 152. **Aira caryophyllea** L. Silvery Hair-grass.—A slender, tufted annual 1 to 3 dm. high, with short leaves and small-flowered, open panicles 2 to 8 cm. long.—In sandy waste places, Massachusetts to Virginia; also on the Pacific Coast. Introduced from Europe. May–August.

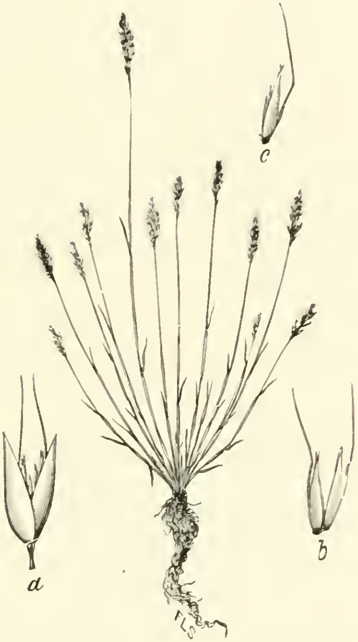


FIG. 153. **Aira præcox** L. EARLY WILD OAT-GRASS.—A tufted, erect or ascending annual 2 to 12 cm. high, with a contracted panicle 1 to 2 cm. long.—Introduced and sparingly distributed in the Middle States near the coast, growing in sandy soil. Also on Vancouver Island. [Europe.] May–July.

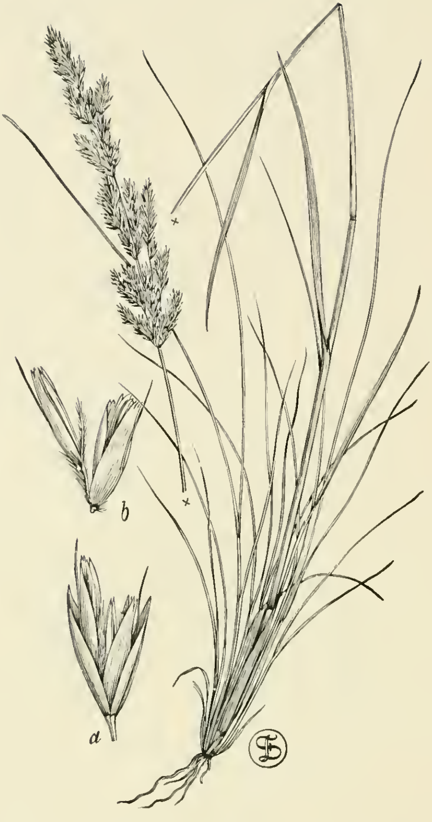


FIG. 154. **Deschampsia holciformis** Presl.; Beal, Grasses N. Am., **2**: 370. CALIFORNIAN HAIR-GRASS.—A stout, erect perennial 6 to 15 dm. high, with long and rather rigid basal leaves and densely flowered, more or less interrupted panicles 12 to 24 cm. long.—Moist meadows, California near the coast. April.

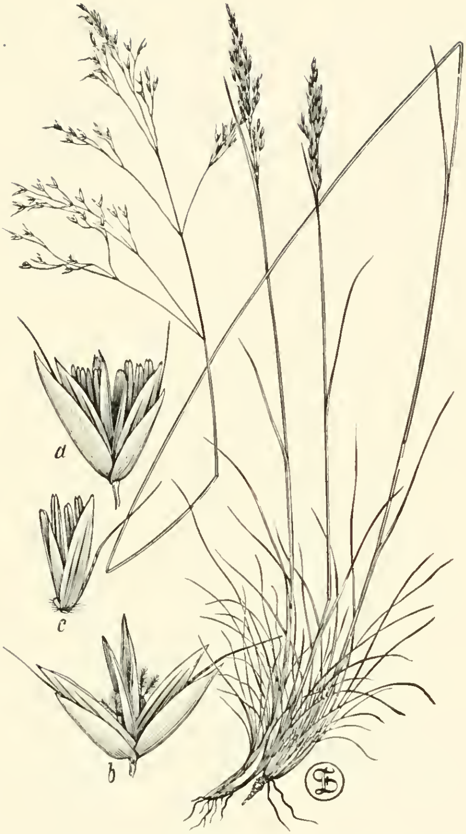


FIG. 155. **Deschampsia flexuosa** (L.) Trin. TUFTED HAIR-GRASS.—A slender, erect perennial about 6 dm. high, with involute-setaceous, radical leaves and diffuse panicles.—Labrador southward along the mountains to North Carolina and Tennessee, and westward from New York to Wisconsin. [Greenland and Europe.] May–August.

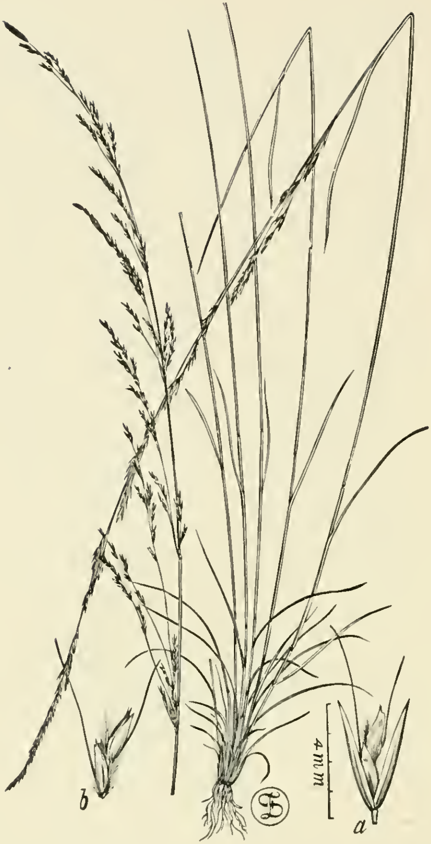


Fig. 156. **Deschampsia elongata** (Hook.) Munro; Beal, Grasses N. Am., **2**: 371. Slender Hair-grass.—A slender perennial 3 to 12 dm. high, with narrow panicles 15 to 38 cm. long.—Montana to British Columbia and southward on the Pacific Slope to Mexico. May–August.

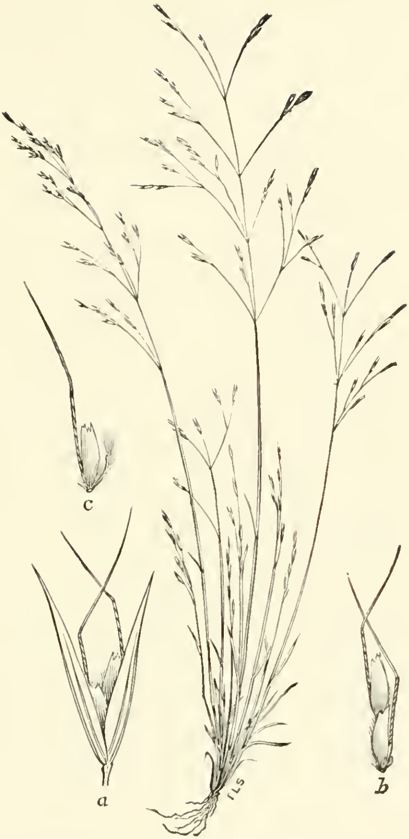


FIG. 157. **Deschampsia calycina** Presl (*Aira danthonioides* Trin.). OAT-LIKE HAIR-GRASS.—A rather slender, erect, cæspitose grass from 1 to 7 dm. high, with more or less spreading panicles.—Native along the Pacific Slope from Canada to California, eastward to Utah, and southward through Mexico to Peru. April–July.

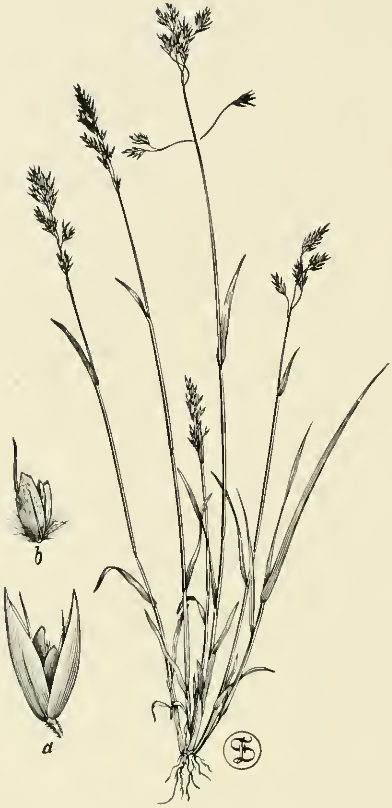


Fig. 158. **Deschampsia atropurpurea** (Wahl.) Scheele. Mountain Hair-grass.—A slender, alpine grass 1.5 to 4 dm. high, with flat leaves and few-flowered, nodding panicles 3 to 12 cm. long.—Labrador, White Mountains, Adirondacks, Rocky Mountains in Colorado, northward to Alaska. [Northern Europe and Asia.] July–September.

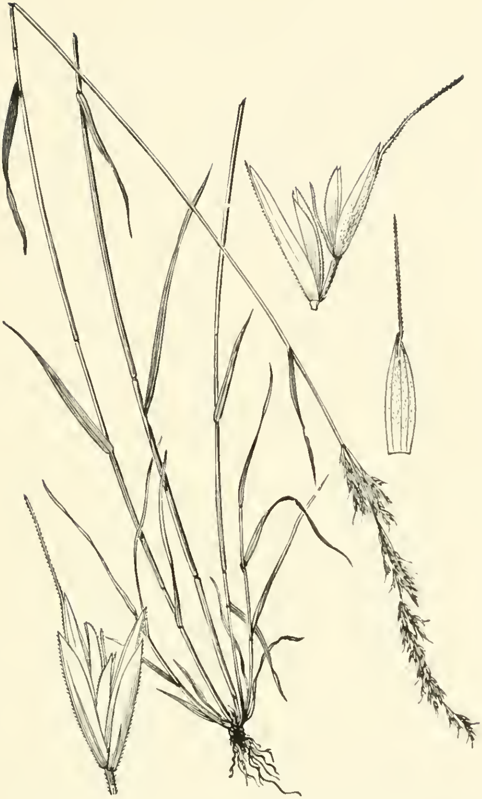


FIG. 159. **Trisetum palustre** (Michx.) Torr. MARSH OAT-GRASS.—A slender, loosely tufted perennial 6 to 9 dm. high, with flat, soft leaves and loosely flowered, nodding, and yellowish green panicles.—On moist rocks, along brooks, in wet meadows, etc., Massachusetts to Illinois, south to Florida and Louisiana; British Columbia. April–June.

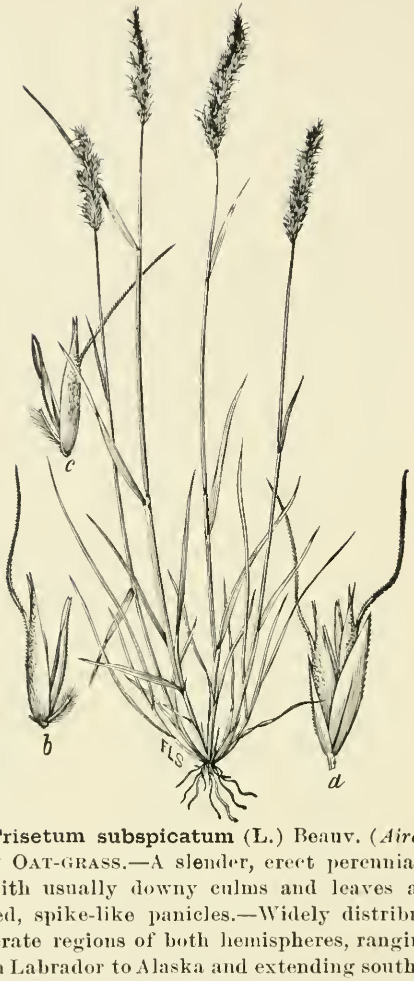


FIG. 160. **Trisetum subspicatum** (L.) Beauv. (*Aira subspicata* L.). DOWNY OAT-GRASS.—A slender, erect perennial 1.5 to 4.5 dm. high, with usually downy culms and leaves and densely many-flowered, spike-like panicles.—Widely distributed in the cooler temperate regions of both hemispheres, ranging in North America from Labrador to Alaska and extending southward in the Eastern States to the mountains of North Carolina and Tennessee, and in the West to New Mexico and California. June-September.

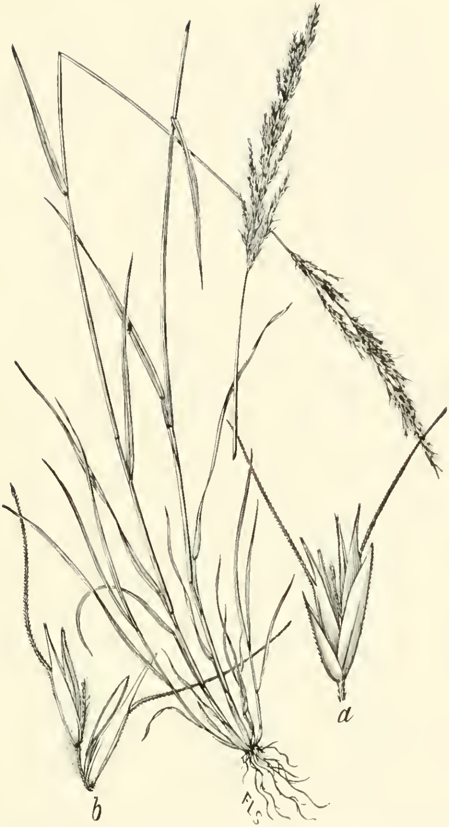


Fig. 161. **Trisetum montanum** Vasey; Beal, Grasses N. Am., **2**: 379. Rocky Mountain Oat-grass.—A slender, erect, or ascending native grass 3 to 8 dm. high, with narrow, flat leaves and many-flowered, more or less contracted panicles 8 to 12 cm. long.—Mountains of Colorado and New Mexico. July, August.

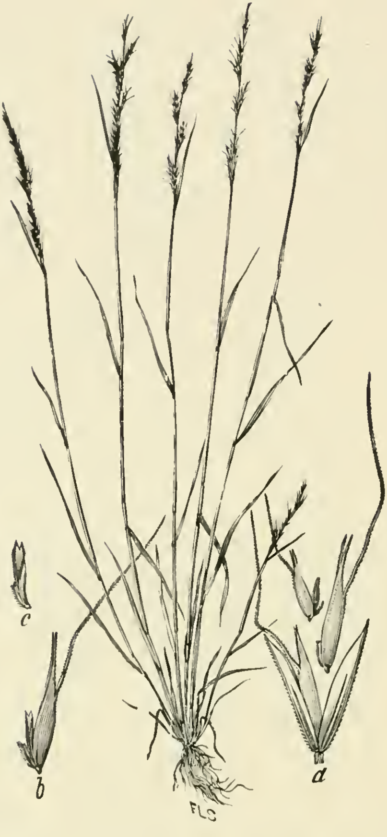


FIG. 162. **Trisetum interruptum** Buckl.; Beal, Grasses N. Am., **2**: 376, under *T. elongatum*. SLENDER OAT-GRASS.—A slender, erect annual 2 to 5 dm. high, with rather short, soft leaves and narrow, elongated panicles 4 to 10 cm. long.—Colorado to Texas, Arizona, and southern California. March–May.

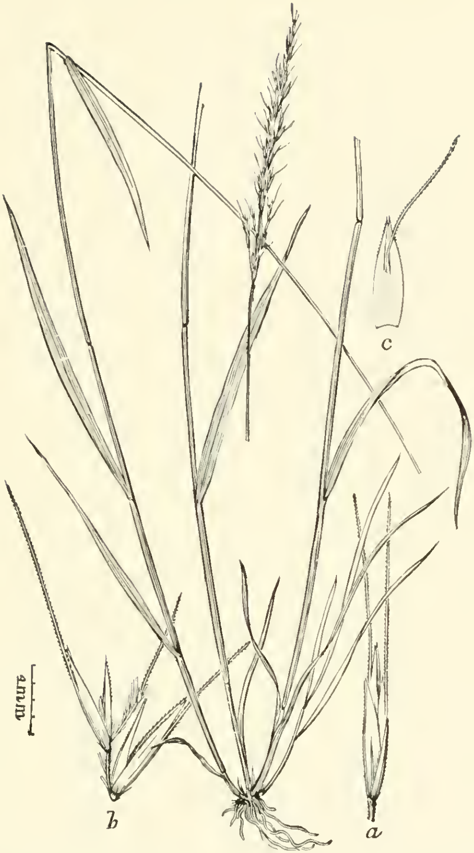


FIG. 163. **Trisetum canescens** Buckl.; Brewer and Wats., Bot. Calif., **2** : 296. SILVERY OAT-GRASS.—An erect perennial 3 to 12 dm. high, with flat leaves, and more or less densely flowered panicles 12 to 18 cm. long.—In dry, open ground, open woods, thickets, and wet meadows, California to British Columbia, east to Montana. May–September.

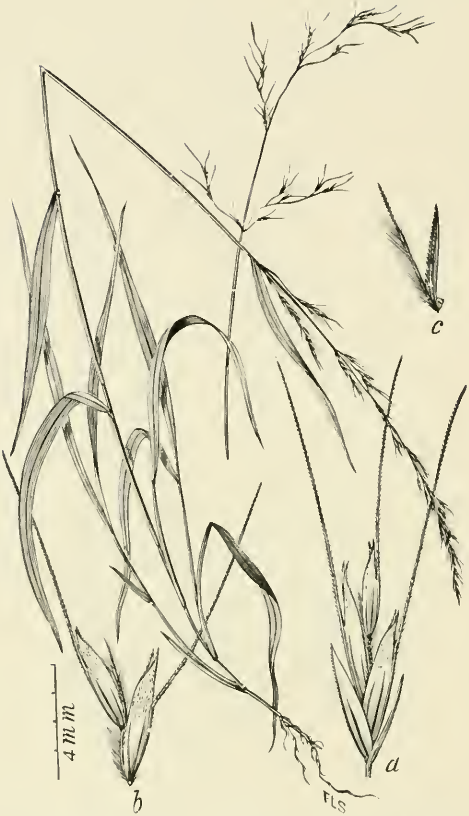


Fig. 164. **Trisetum cernuum** Trin.; Beal, Grasses N. Am., **2**: 379. Nodding Oat-grass.—A slender perennial 6 to 10 dm. high, with rather broad, flat leaves and loosely flowered, nodding panicles 12 to 20 cm. long.—Alaska to northern California and eastward to Idaho. May–July.

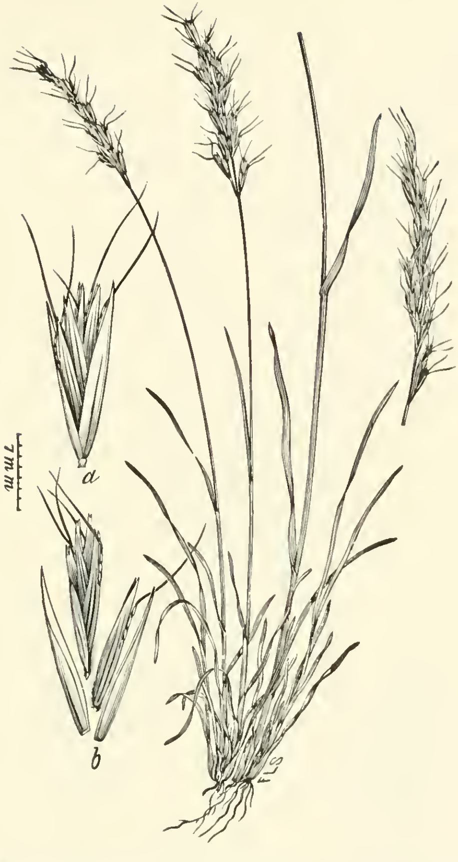


FIG. 165. **Avena americana** (Scribn.) (*A. pratensis* var. *americana* Scribn.; *A. hookeri* Scribn.). AMERICAN OAT.—A rigidly erect perennial 3 to 6 dm. high, with narrow, firm leaves, and contracted panicles 8 to 12 cm. long.—Open thickets and prairies, Manitoba, and in the foothills of the Rocky Mountains southward to Colorado. June–August.

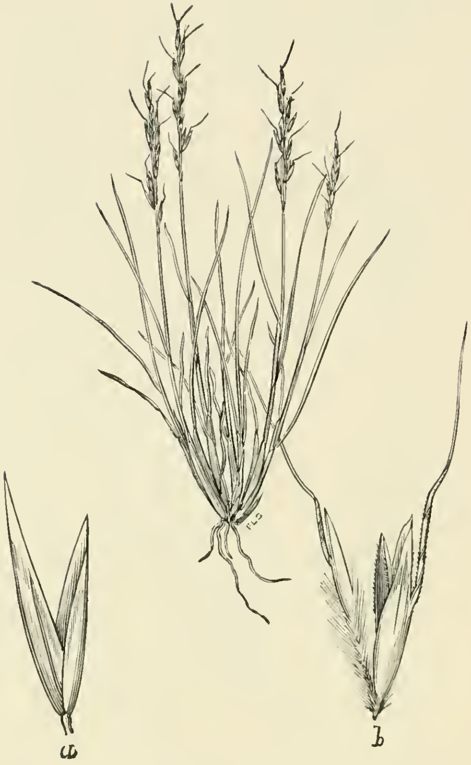


FIG. 166. **Avena mortoniana** Scribn.; Bot. Gaz., **21**: 133. MORTON'S OAT-GRASS.—A densely cæspitose, erect perennial 1 to 2.5 dm. high, with rather rigid leaves and narrow, simple panicles of one- to two-flowered spikelets.—At 3,900 to 4,200 m. altitude, mountains of Colorado. August.

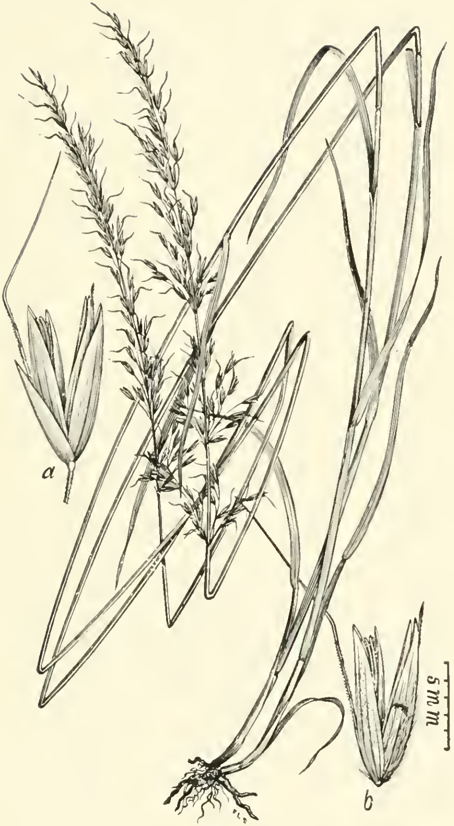


FIG. 167. **Arrhenatherum elatius** (L.) Beauv. (*Avena elatior* L.). TALL OAT-GRASS.—A loosely tufted perennial 6 to 12 dm. high, with flat leaves and narrow, loosely flowered panicles 15 to 20 cm. long.—Introduced from Europe as a fodder grass. Valuable; in Europe regarded as one of the best meadow grasses. May, June.

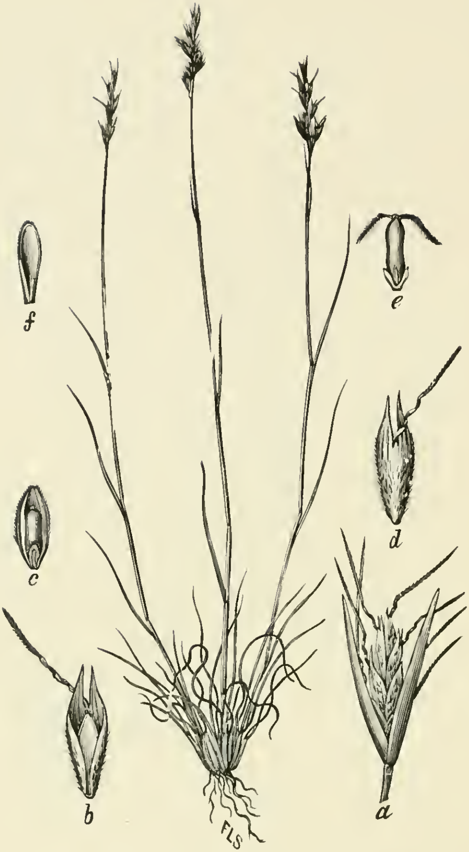


Fig. 168. **Danthonia spicata** (L.) Beauv. (*Avena spicata* L.). Wild Oat-grass.—A smooth, slender, erect perennial 2.5 to 5 dm. high, with a few-flowered, narrow panicle spreading only in flower.—Common in dry, thin soils from Canada southward to the Gulf States and westward to Texas. May–September.

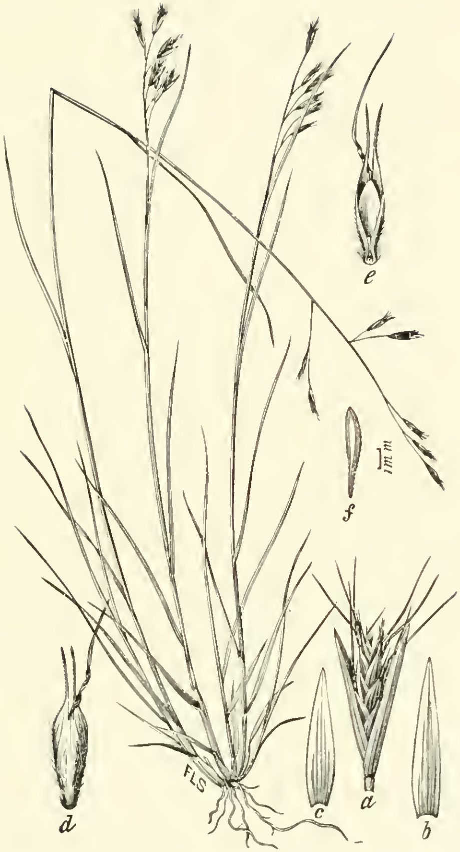


FIG. 169. **Danthonia compressa** Austin. TENNESSEE OAT-GRASS.—A slender, erect, tufted perennial 2 to 6 dm. high, with long, narrow root leaves, and few-flowered open panicles.—Mountain regions of eastern Tennessee and North Carolina northward to Canada. June–August.

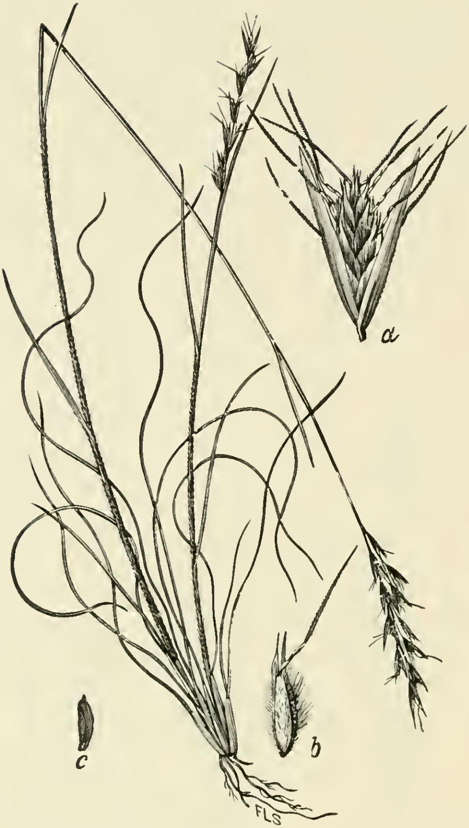


FIG. 170. **Danthonia sericea** Nutt. SILKY OAT-GRASS.—A rather stout, erect perennial 3 to 9 dm. high, with usually pubescent sheaths, rather rigid leaves, large spikelets, and terminal, few-flowered panicles.—Open woodlands in dry soil, Massachusetts and New Jersey to Florida and west to Tennessee and Alabama. May, June.

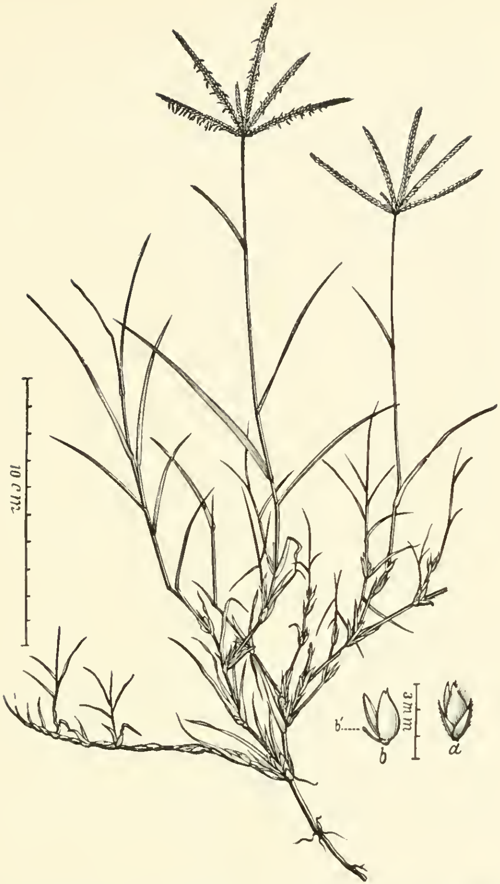


FIG. 171. **Capriola dactylon** (L.) Kuntze (*Panicum dactylon* L.; *Cynodon dactylon* Pers.). BERMUDA-GRASS.—A creeping perennial, with upright or ascending, leafy flowering branches 1 to 6 dm. high.—Widely dispersed over the tropical and warmer temperate regions of the world, in the United States from Pennsylvania southward to Florida and westward to Texas and California. April–October. (The name *Capriola* may belong to *Panicum sanguinale.*)

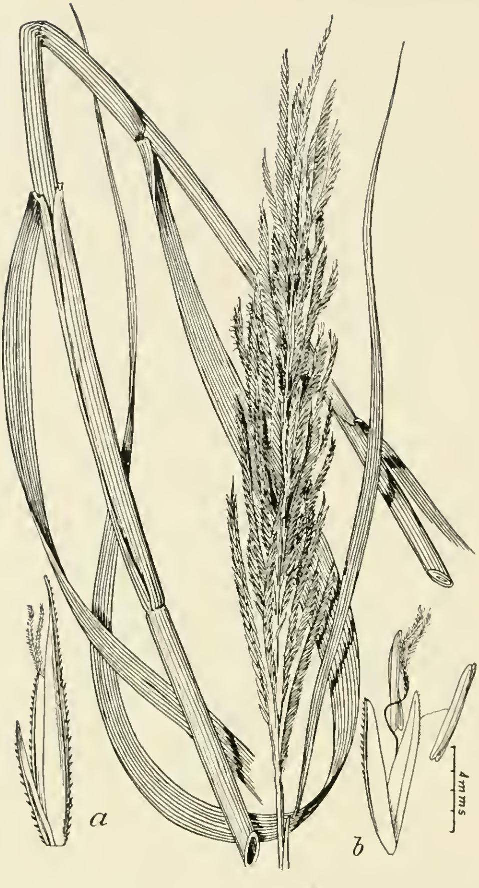


FIG. 172. **Spartina polystachya** (Michx.) Ell. (*Trachynotia polystachya*). SALT REED-GRASS.—A stout, erect perennial 12 to 27 dm. high, with long, flat leaves and terminal panicles of twenty to fifty crowded, ascending spikes 5 to 10 cm. long.—Brackish marshes along the coast, Maine to Mississippi. July–October.

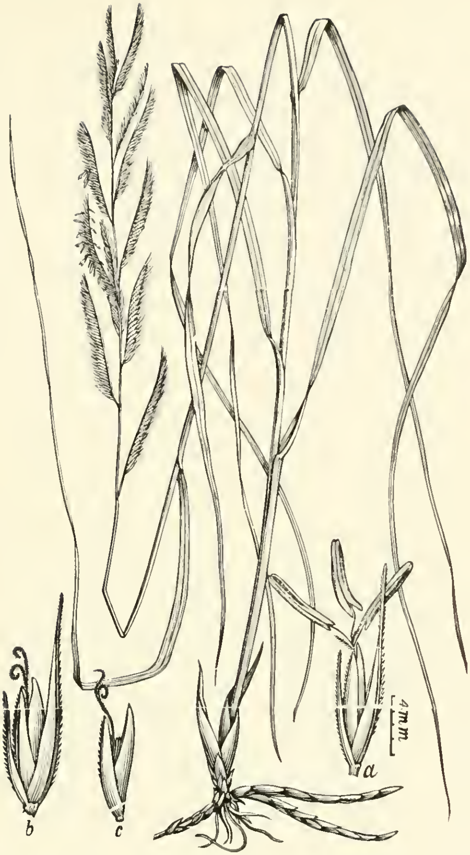


FIG. 173. **Spartina cynosuroides** (L.) Willd. FRESHWATER CORD-GRASS.—A stout, erect grass 6 to 18 dm. high, with unbranched, smooth culms from strong, scaly, creeping rootstocks, long, tough leaf blades, and five to twenty spikes, forming a terminal panicle.—River banks and lake shores, also brackish coast marshes, Maine and Nova Scotia to Assiniboia and Oregon, south to New Jersey, western Tennessee, Texas, and Colorado. July–October.

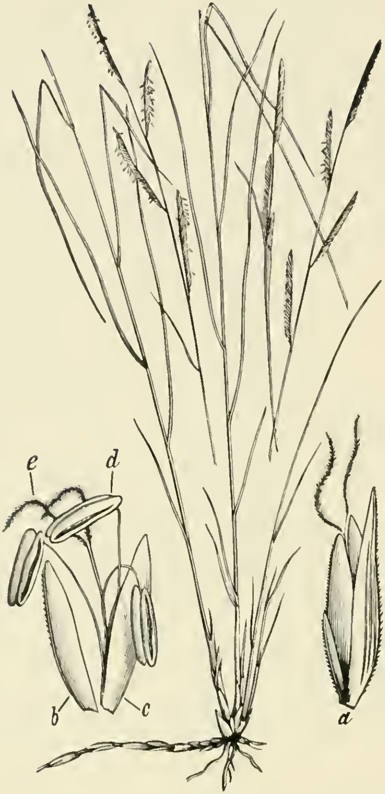


FIG. 174. **Spartina patens** (Ait.) Muhl. (*Dactylis patens* Ait.; *Spartina juncea* Ell.). FOX-GRASS.—A rather slender and somewhat wiry grass 3 to 6 (rarely 9) dm. high, with two to four slender, erect or widely spreading spikes.—Salt marshes and sandy shores along the coast from Newfoundland to Florida and westward to Texas. June–September.

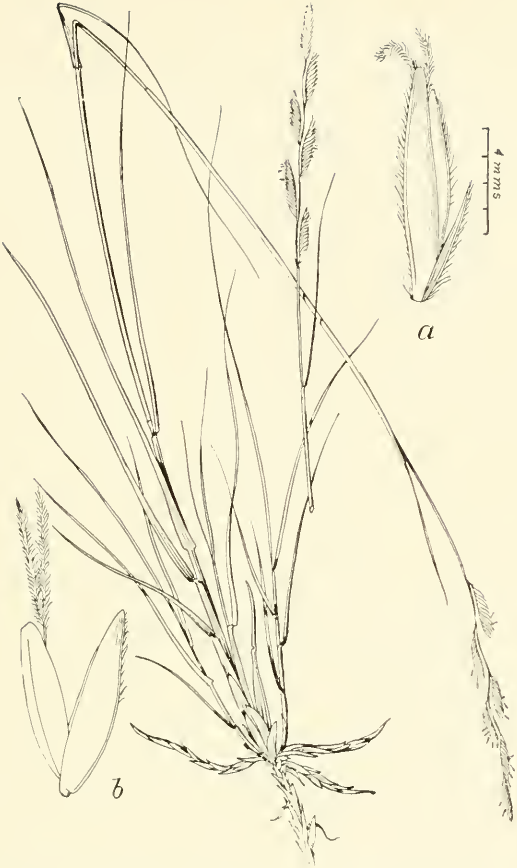


FIG. 175. **Spartina gracilis** Trin. WESTERN CORD-GRASS.—A comparatively slender, perennial species 3 to 9 dm. high, with flat leaves, and three to nine rather short, appressed spikes.—Meadows, swamps, and river bottoms, especially in alkaline soils, South Dakota to Kansas, west to British Columbia, Nevada, and California. March–August.

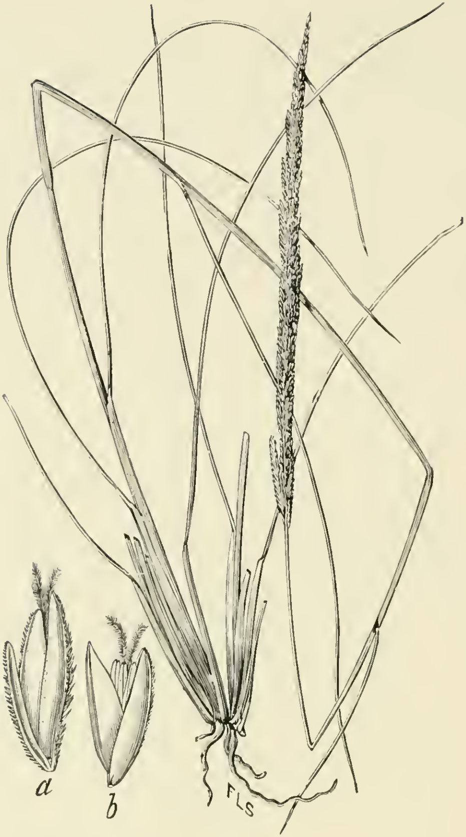


FIG. 176. **Spartina junciformis** Engelm. & Gray (*S. densiflora* Brongn. (?); *S. gouini* Fourn.); Beal, Grasses N. Am., **2**: 400. RUSH-LIKE SPARTINA.—A stout perennial 6 to 15 dm. high, with very long, narrow leaves and short, appressed spikes, which form a cylindrical, spike-like inflorescence 10 to 30 cm. long.—Brackish marshes along the Gulf Coast, Key West, Florida to Texas. [Mexico and Chile. ?] June–October.

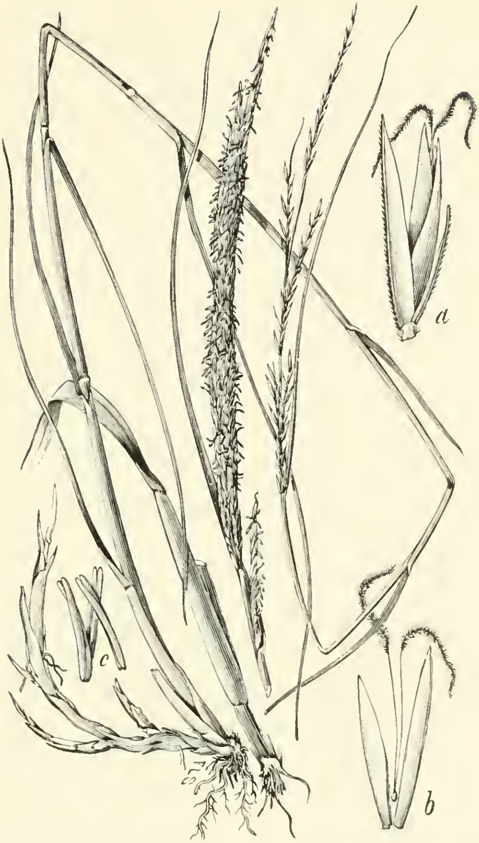


FIG. 177. **Spartina stricta maritima** (Walt.) Scribn. (*Dactylis maritima* Walt.; *Spartina glabra* Muhl.). CREEK SEDGE or THATCH.—An erect and often stout salt-marsh grass from 6 to 24 dm. high, with long, flat leaves and few to many, erect, appressed spikes.—Along ditches and creeks of the salt marshes of both the Atlantic and Pacific coasts. July–October.

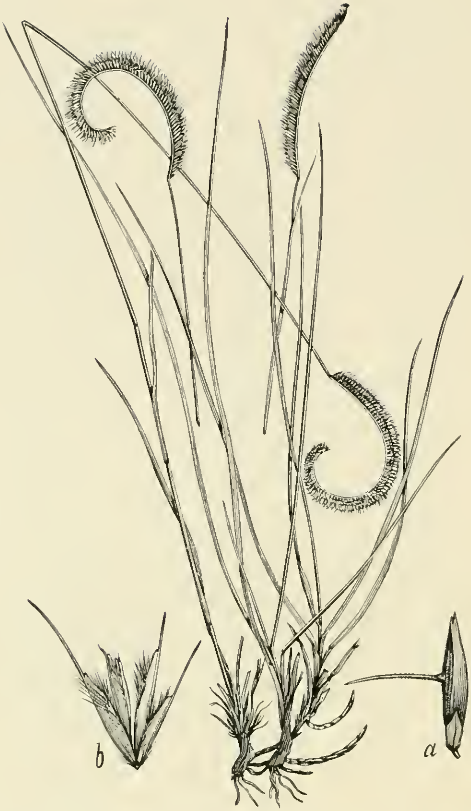


FIG. 178. **Campulosus aromaticus** (Walt.) Trin. (*Ægilops aromatica* Walt.; *Ctenium americanum* Spreng.). TOOTHACHE-GRASS.—An erect perennial 9 to 12 dm. high, from strong, lemon-scented and pungent rootstocks, with narrow leaves and usually a single, terminal, curved, pectinate spike 4 to 10 cm. long.—Southern Virginia to Florida and westward to Mississippi. July, August.

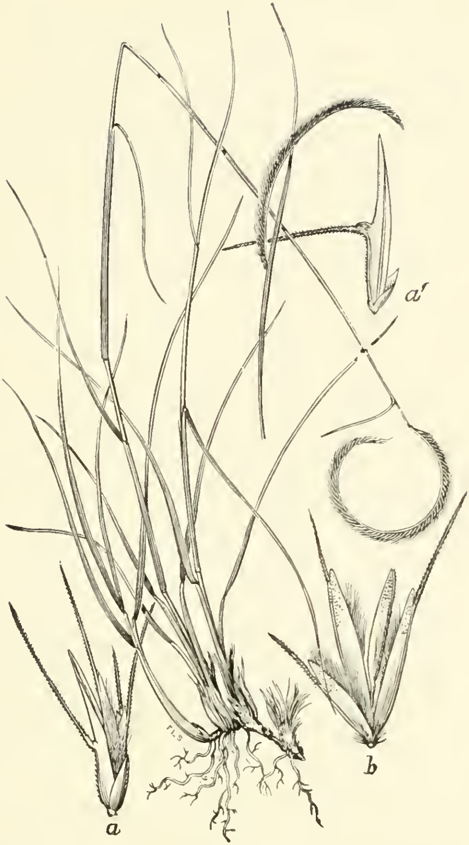


FIG. 179. **Campulosus chapadensis** Trin. (*Ctenium chapadense* Doell).—An erect perennial 8 to 12 dm. high, with narrow leaves and usually single, terminal, more or less curved spikes. More slender than *C. aromaticus*, with narrower glumes, and more delicate and longer awns.—Florida, in the "flat woods" regions. July–October.

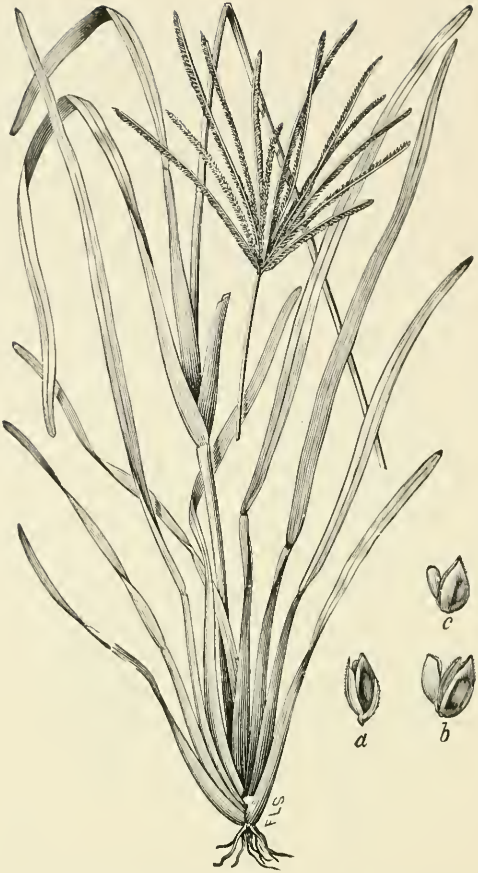


FIG. 180. **Chloris glauca** (Chapm.) Vasey (*Eustachys glauca* Chapm.); Beal, Grasses N. Am., **2**: 408. SMOOTH CHLORIS.—A strong-growing perennial, with diffusely spreading and ascending culms 6 to 12 dm. long, bearing 10 to 25 slender terminal spikes. Culms and sheaths strongly flattened.—Brackish marshes and along the borders of cypress swamps, Florida. July–September.

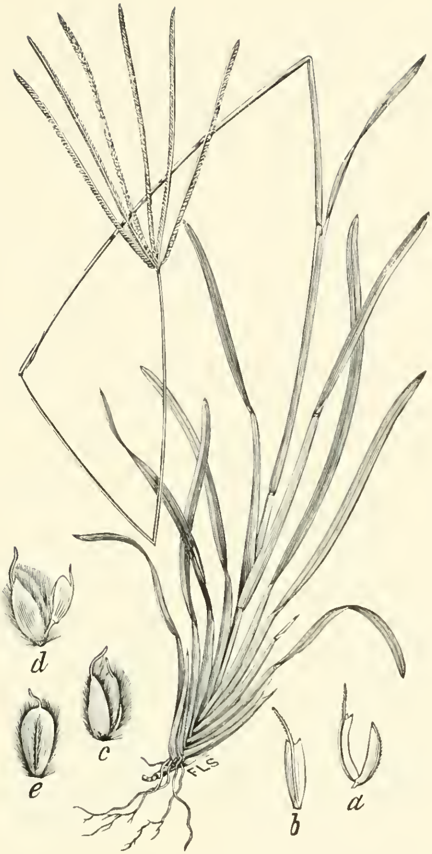


Fig. 181. **Chloris neglecta** Nash in Bull. Torr. Bot. Club., **22**: 423.—A rather stout perennial 6 to 12 dm. high, with compressed, glabrous culms and sheaths, flat leaves 10 to 35 cm. long, and four to six terminal spikes 8 to 12 cm. long. Closely allied to and much resembling *C. floridana*.—Low pine lands, Florida. October.

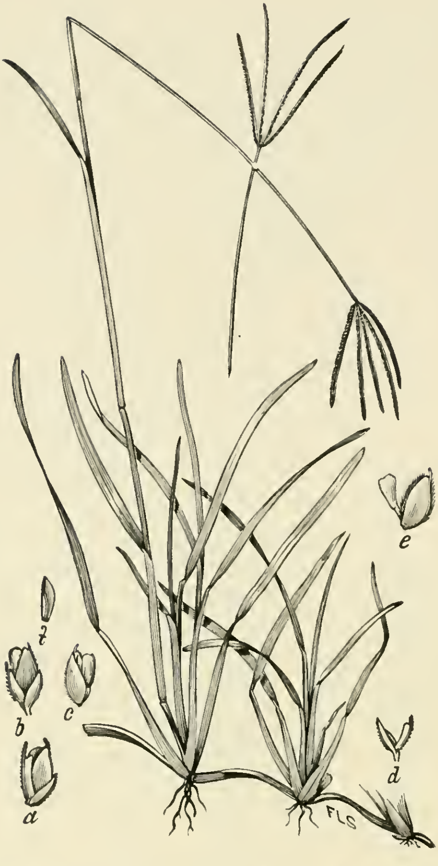


FIG. 182. **Chloris petræa** Sw.; Beal, Grasses N. Am., **2** : 408 (sub. *C. swartziana* Doell). SEASIDE FINGER-GRASS.—A creeping, glaucous perennial 3 to 6 dm. high, with obtuse, flat leaves and three to eight slender spikes 4 to 7 cm. long.—Southern Florida to southeastern Texas. [West Indies and Central and South America.] March–October.

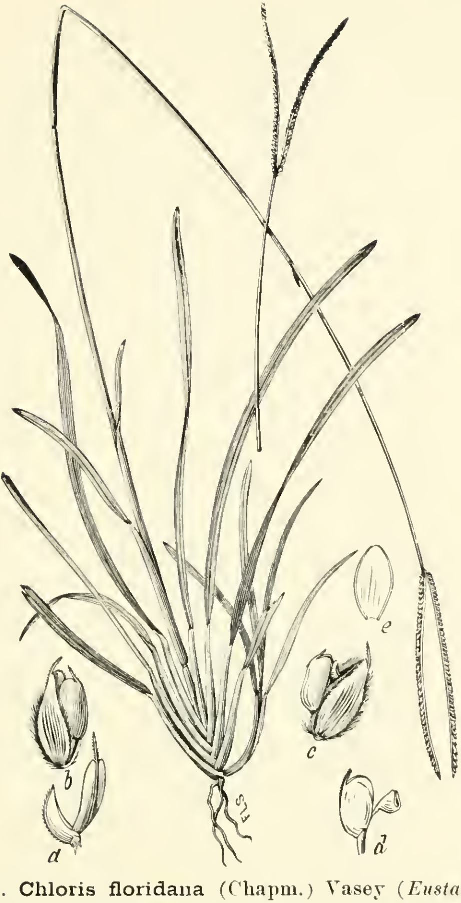


FIG. 183. **Chloris floridana** (Chapm.) Vasey (*Eustachys floridana* Chapm.); Beal, Grasses N. Am., **2** : 407.—A smooth, rather slender perennial 3 to 6 dm. high, with compressed culms and sheaths, flat leaves and one or two spikes 6 to 8 cm. long. The spikes in this and in *C. neglecta* are stouter than in *C. petræa*.—Dry, sandy soil, Florida. July–October.

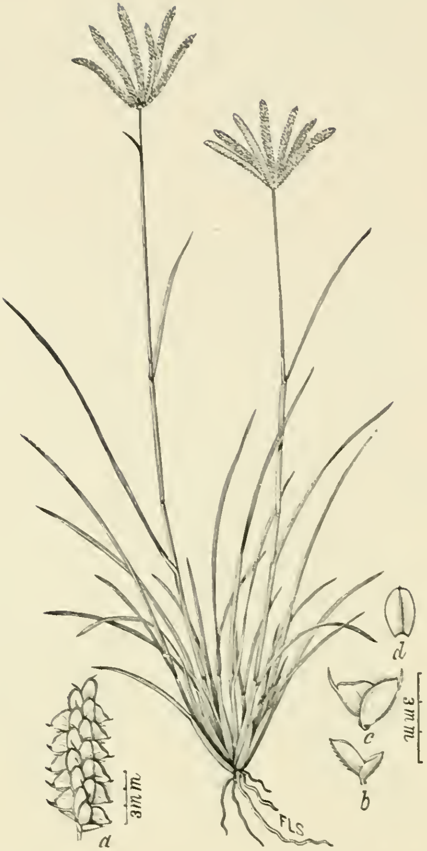


FIG. 184. **Chloris cucullata** Bisch.; Beal, Grasses N. Am., **2**: 407.—A rather slender, cæspitose perennial 2 to 4 dm. high, with narrow, flat leaves and eight to twelve spikes digitate or umbellate at the apex of the culms. Uppermost glumes cucullate.—Sandy plains, Texas to Arkansas. March–September.

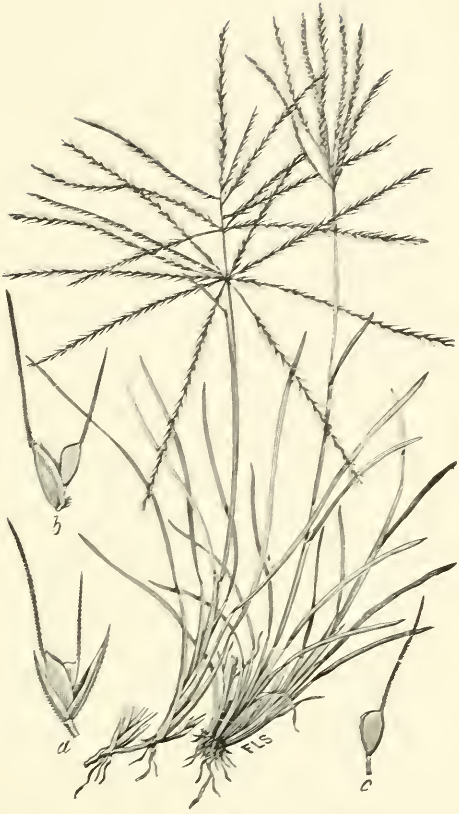


Fig. 185. **Chloris verticillata** Nutt. Windmill-grass.—A low, spreading perennial, with rather stout, upright flowering branches 1.5 to 5 dm. high and numerous widely spreading, slender spikes 8 to 13 cm. long.—Prairies, Kansas to Texas. A good turf former. May–September.

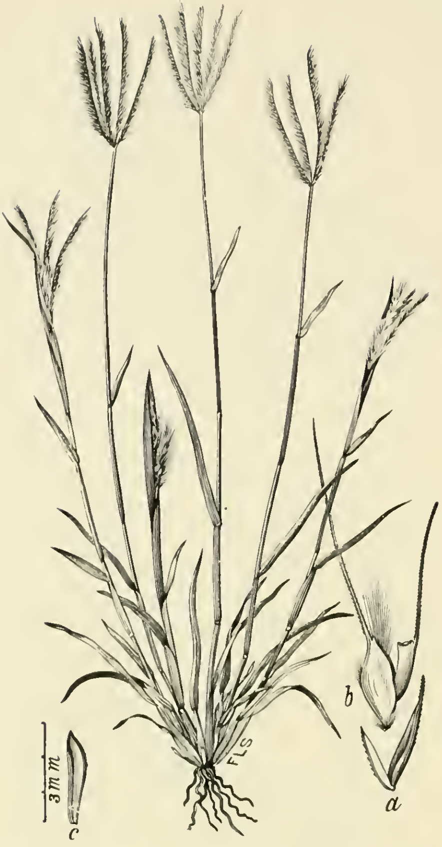


FIG. 186. **Chloris elegans** HBK. (*C. alba* Presl); Beal, Grasses N. Am., **2** : 403.—An erect perennial 3 to 6 dm. high, with slightly inflated sheaths, flat leaves and eight to twelve silky-bearded spikes, clustered or umbellate at the apex of the culms.—Dry mesas and desert hills of western Texas, southern Arizona, New Mexico, southern California and southward. An ornamental grass. June–November.

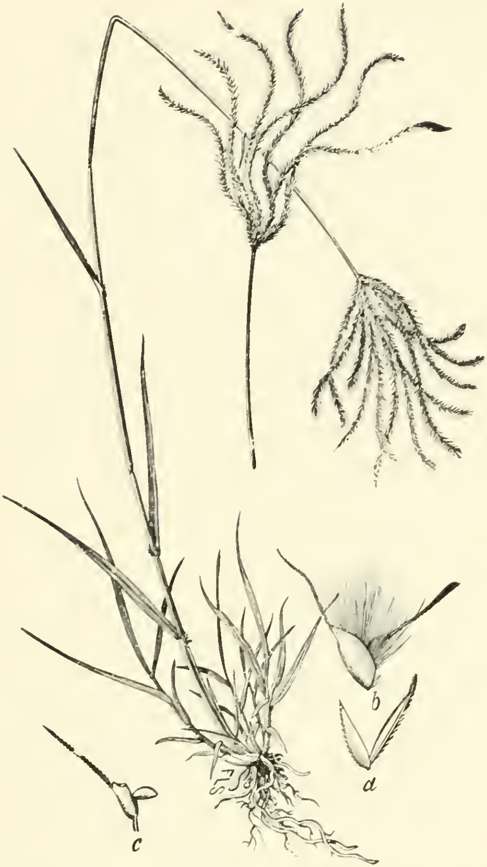


FIG. 187. **Chloris polydactyla** (L.) Sw. (*Andropogon polydactylon* L.). MANY-SPIKED CHLORIS.—A rather stout, leafy perennial about 6 dm. high, with numerous, more or less flexuose, brownish spikes 8 to 13 cm. long.—Florida. [West Indies and South America.]

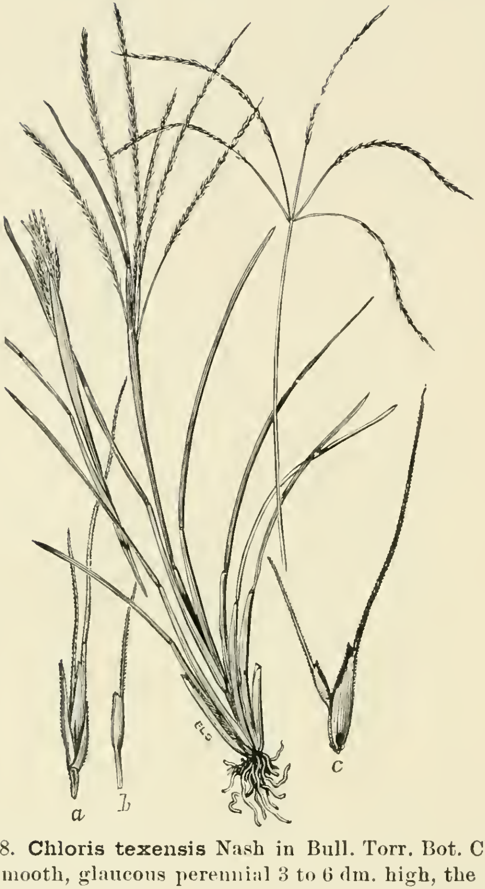


FIG. 188. **Chloris texensis** Nash in Bull. Torr. Bot. Club, **23**: 151.—A smooth, glaucous perennial 3 to 6 dm. high, the crowded lower sheaths compressed, with flat leaves and five to eight slender, terminal, digitate spikes 10 to 18 cm. long.—Texas. [Mexico?.]

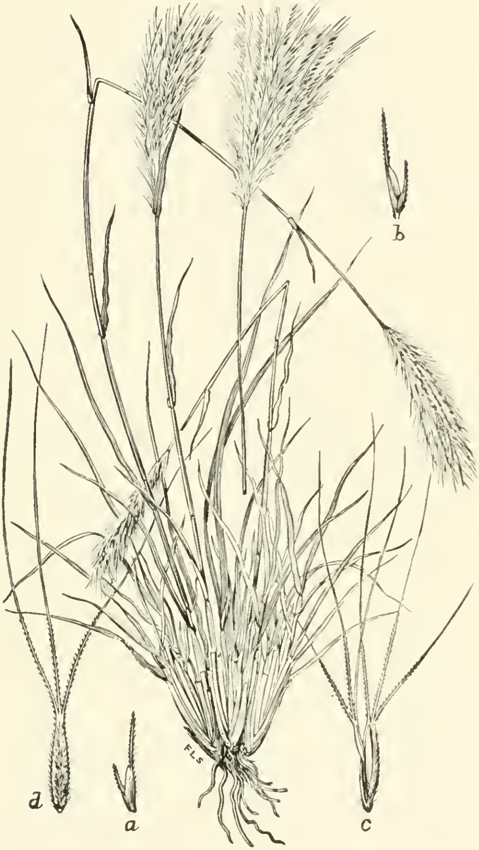


FIG. 189. **Trichloris blanchardiana** Scribn. (*T. fasciculata* Fourn.).—A rather stout perennial 5 to 10 dm. high, with long, narrow leaves and many, slender, bearded spikes, which are fasciculate or subdigitate at the apex of the culm.—Dry plains and mesas, Texas to Arizona. May–September.

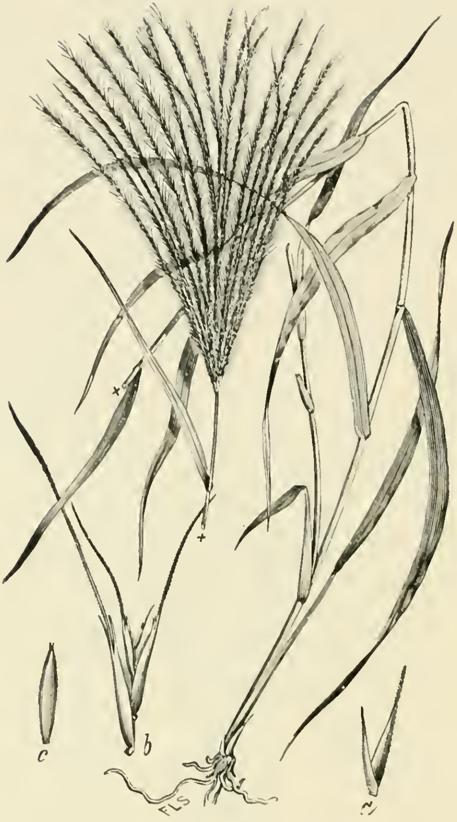


Fig. 190. **Trichloris pluriflora** Fourn. Many-flowered Trichloris.—A glaucous, erect perennial 6 to 12 dm. high, with long, flat leaves and numerous erect, many-flowered, bearded spikes 8 to 15 cm. long. Spikelets three- to four-flowered.—Southern and western Texas. [Mexico.] May–July.

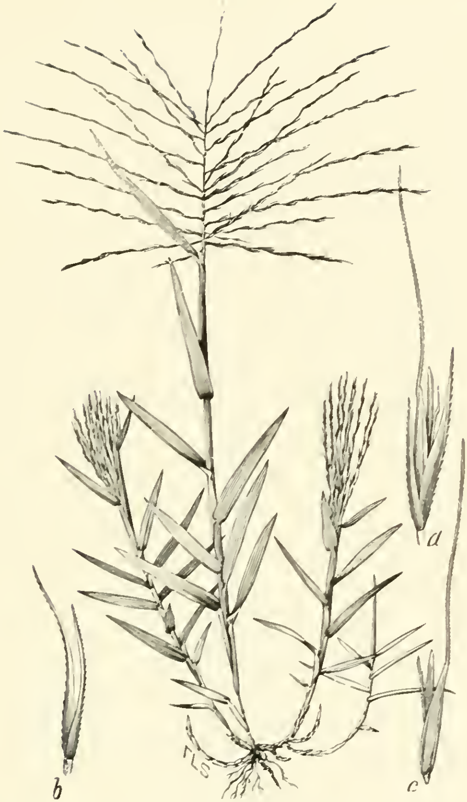


FIG. 191. **Gymnopogon ambiguus** (Michx.) B. S. P.; Britton and Brown, Ill. Fl., **1**: 178 (*G. racemosus* Beauv.). NAKED BEARD-GRASS.—A loosely tufted, erect or ascending perennial 30 to 45 cm. high, with short and broad leaf blades and numerous (fifteen to thirty), slender and widely spreading spikes irregularly scattered along the common rachis.—Dry soil, fields, hillsides, and borders of woods, New Jersey to Missouri, Indian Territory, Texas, and Florida. July–October.

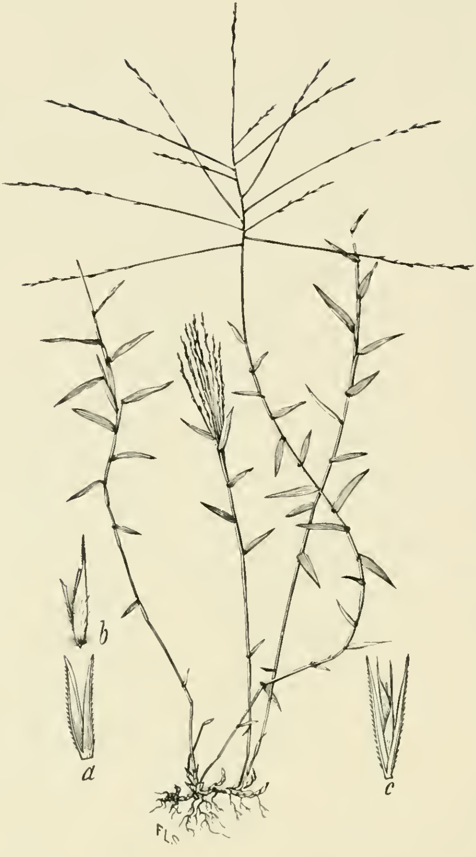


Fig. 192. **Gymnopogon brevifolius** Trin. Short-leafed Beard-grass.—A slender, loosely tufted and many-jointed perennial, with erect or ascending culms 3 to 6 dm. high, short, flat leaves and numerous very slender spikes, which are naked toward the base.—Dry or moist pine barrens near the coast, New Jersey to Mississippi. August–November.

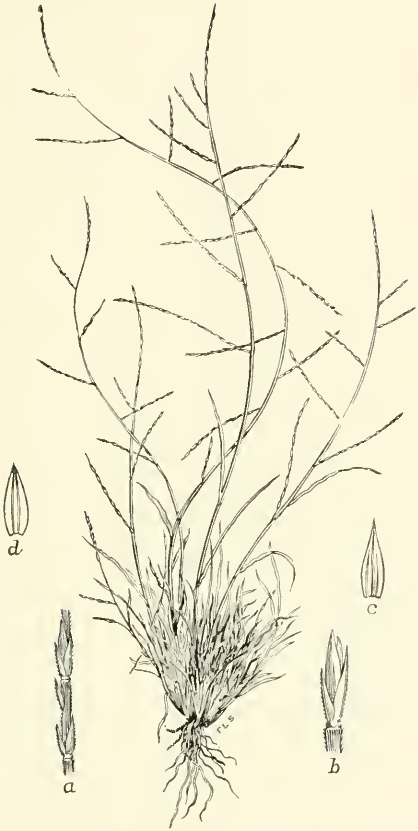


FIG. 193. **Schedonnardus paniculatus** (Nutt.) Trelease; Britton and Brown, Ill. Fl., **1** : 179 (*S. texanus* Steud.). TEXAN CRAB-GRASS.—A low, diffusely branching annual, with short, narrow leaves and slender, paniculate spikes. The tufted stems vary from 1 to 9 dm. long.—Dry prairies, Illinois to Texas and New Mexico, north to Assiniboia and Manitoba. April–October.

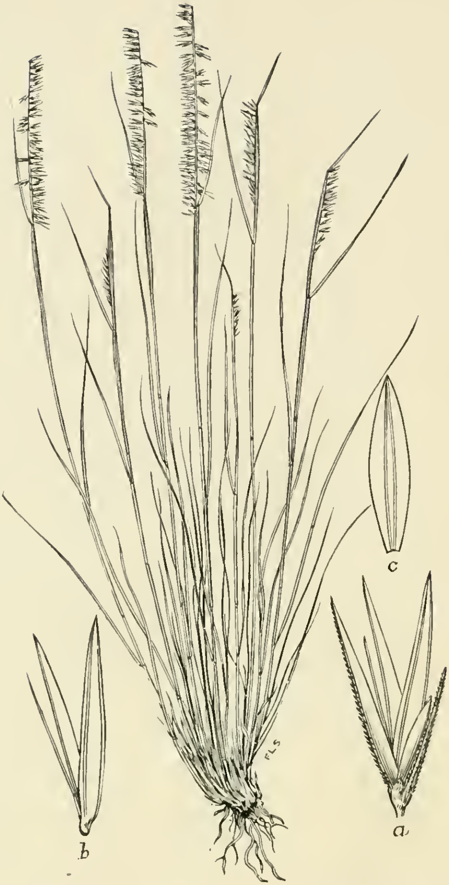


Fig. 194. **Bouteloua uniflora** Vasey; Beal, Grasses N. Am., **2**: 426. One-flowered Grama.—A slender, erect perennial 3 to 4.5 dm. high, with narrow, long-attenuate-pointed leaves and numerous (twenty-five to seventy-five), spreading or deflexed one-flowered spikes approximate along the common axis.—Southwestern Texas. September.

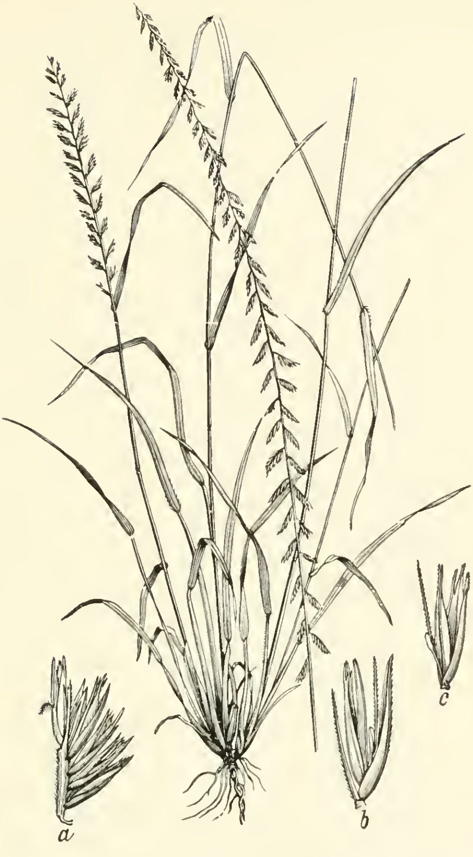


FIG. 195. **Bouteloua curtipendula** (Michx.) Torr. (*B. racemosa* Lag.). TALL GRAMA OR SIDE OATS.—A densely tufted perennial 3 to 9 dm. high, with numerous (twenty to sixty), usually spreading or reflexed spikes scattered along the common axis, forming a long, somewhat one-sided raceme 20 to 40 cm. long.—Dry fields, hillsides, and prairies, New York and Ontario to New Jersey, Mississippi, Texas, California, and Manitoba. [Mexico and Central and South America.] May–October.

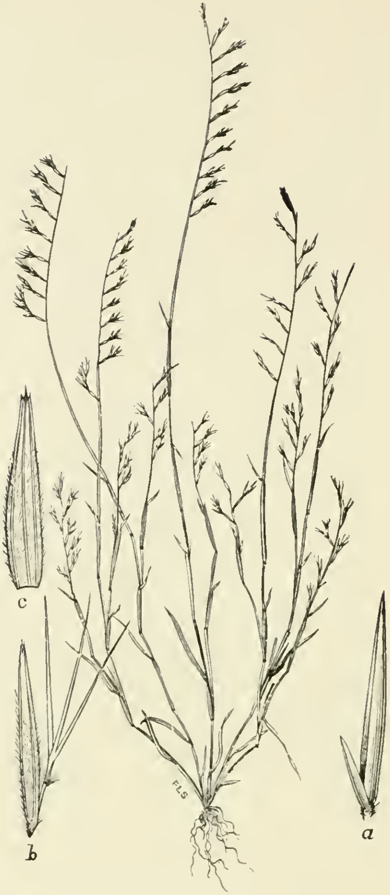


FIG. 196. **Bouteloua aristidoides** Thurb.; Beal, Grasses N. Am., **2** : 425. SIX-WEEKS MESQUIT.—A slender, densly tufted and much branched annual (?) 1 to 3.5 dm. high, with short, narrow leaves, and three to twelve very narrow and few- (sometimes only one-) flowered spikes.—Texas to southern California. [Mexico and Lower California.] August. September.

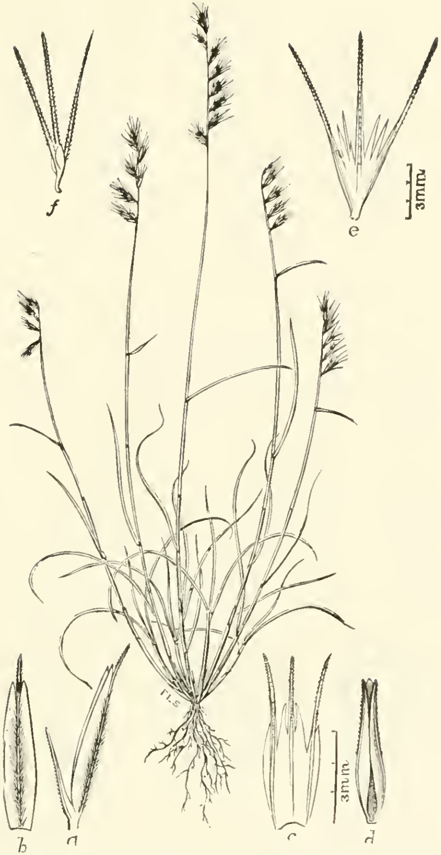


FIG. 197. **Bouteloua texana** S. Wats.; Beal, Grasses N. Am., **2**: 426. TEXAN GRAMA.—A densely cæspitose, usually glabrous perennial 2 to 3 dm. high, with narrow, flat leaves, and two to ten short, many-awned spikes, approximate on the common rachis.—Dry soil, Texas and Indian Territory to Arkansas. March, April.

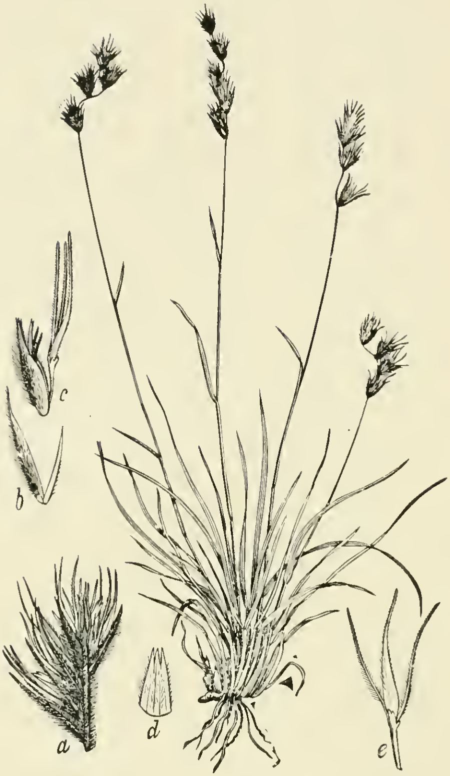


FIG. 198. **Bouteloua havardi** Vasey; Beal, Grasses N. Am. **2**: 424. Havard's Grama.—A perennial, with strong rhizomes, upright culms 2 to 4 dm. high, and four to six short, silky-villous spikes approximate on the common rachis.—Sandy plains, rocky hills, canyons, about springs, etc., Texas to Arizona. [Northern Mexico.] April–September.

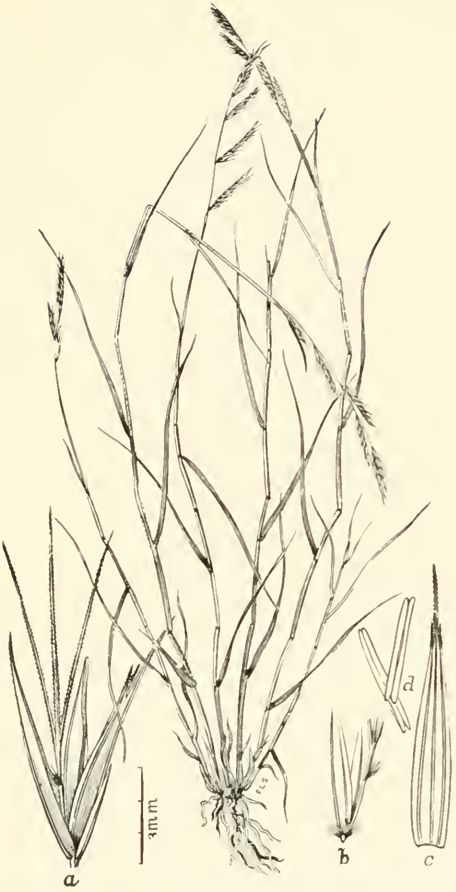


FIG. 199. **Bouteloua eriopoda** Torr.; Beal, Grasses N. Am., **2**: 421. WOOLY-JOINTED GRAMA.—A slender, branching, and somewhat wiry perennial with wooly-jointed stems 2 to 3.5 dm. long, with three to six slender, spreading, and rather loosely flowered spikes 1.5 to 2.5 cm. long.—Dry, gravelly soil, Texas to Arizona. [Northern Mexico.] August, September.

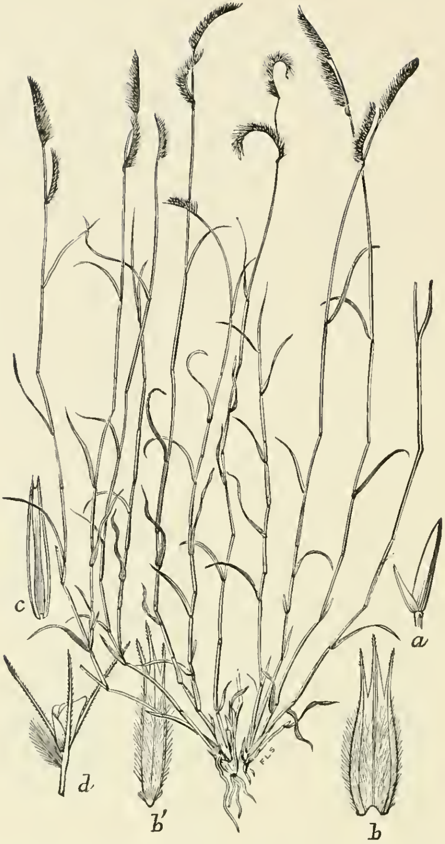


FIG. 200. **Bouteloua ramosa** Scribn.: Vasey, Grasses of the S. W., **1**: 44. WIRY GRAMA.—An erect or ascending perennial, with branching and many-jointed culms 3 to 4.5 dm. high, short, narrow, spreading leaves, and one to three spreading and more or less arcuate spikes 1 to 3 cm. long.—In canyons, mountains of southwestern Texas. [Northern Mexico.] August, September.

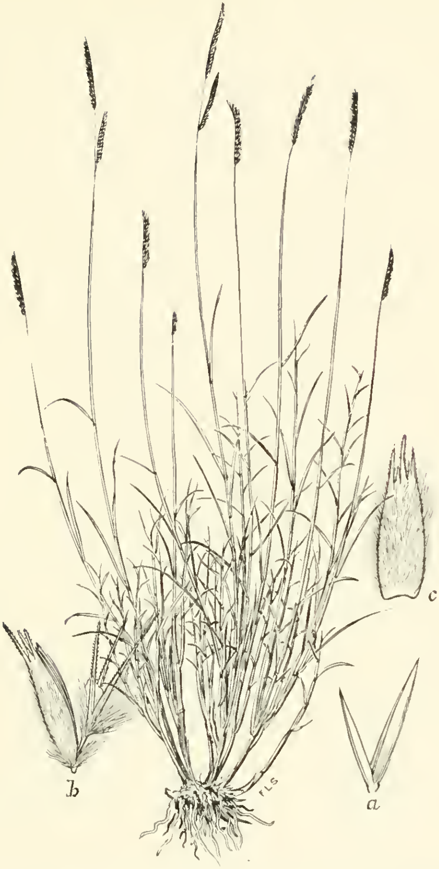


FIG. 201. **Bouteloua breviseta** Vasey; Beal, Grasses N. Am., **2**: 420. SHORT-AWNED GRAMA.—An erect, somewhat wiry and densely cæspitose perennial 2.5 to 3.5 dm. high, the lower internodes covered with a thin white bloom. Leaves very narrow, 2 to 4 cm. long. Spikes one to three, erect or somewhat divergent, about 2 cm. long.—Southwestern Texas. September.

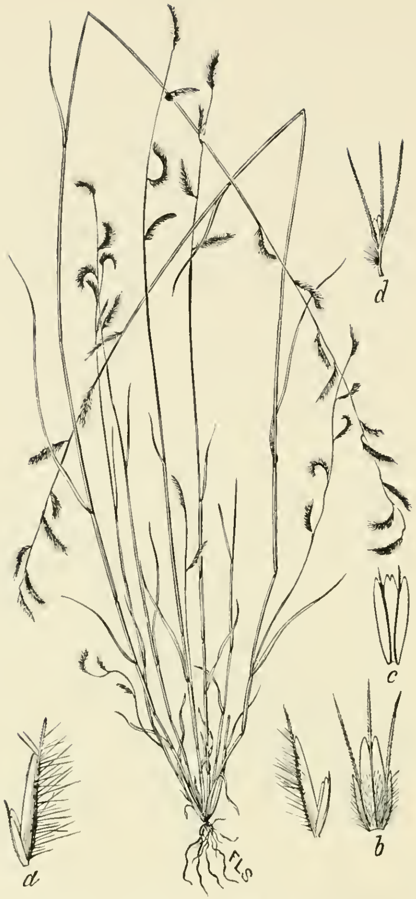


FIG. 202. **Bouteloua vestita** (S. Wats.) Scribn.; Beal, Grasses N. Am., **2**: 419. HAIRY GRAMA.—A tufted annual, with erect or ascending slender culms 3 to 6 dm. high, with short, flat leaves and two to eight ascending, many-flowered, hairy spikes about 2 cm. long.—Sandy banks of streams and "benches" on mountain sides, western Texas to southern Arizona. [Mexico.] September, October.

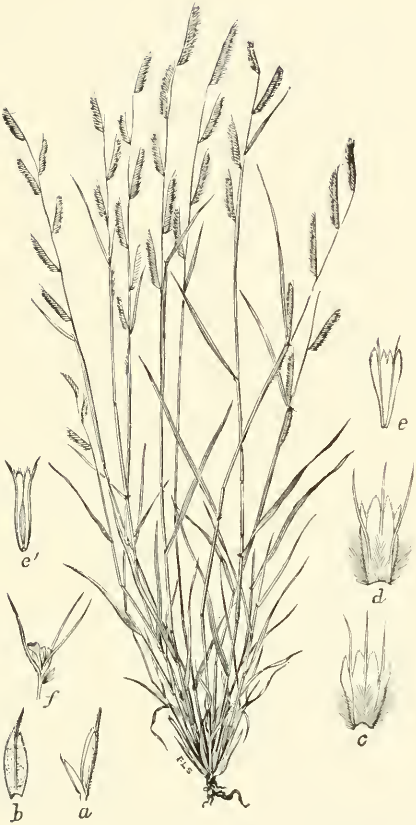


FIG. 203. **Bouteloua rothrockii** Vasey. ROTHROCK'S GRAMA.—A densely cæspitose perennial, with erect, simple or sparingly branched leafy culms 1.5 to 2 dm. high, and five to nine more or less spreading, densely flowered spikes 2 to 3 cm. long.—Sandy plains, mesas and foothills, Arizona. [Mexico.] August, September.

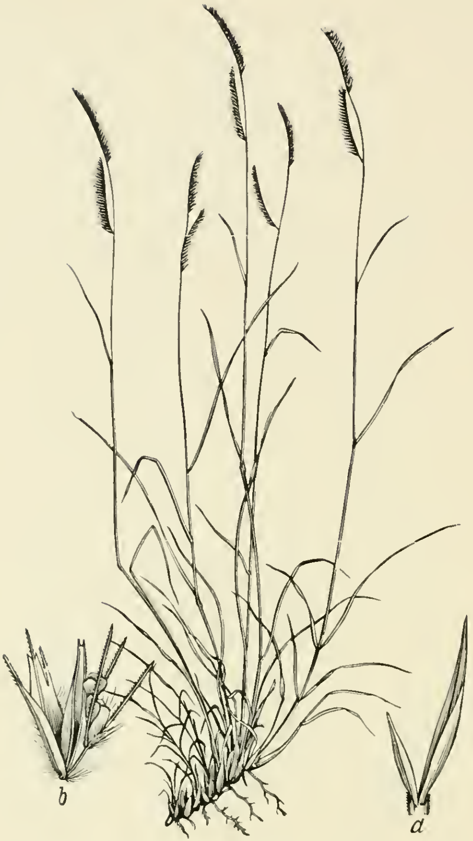


FIG. 204. **Bouteloua oligostachya** (Nutt.) Torr. BLUE GRAMA.—A slender perennial 1.5 to 5 dm. high, with one to five remote, pectinately many-flowered, usually spreading spikes 2.5 to 5 cm. long.—Wisconsin to Montana, north to Manitoba and Alberta, south to Texas, Arizona, and southern California; also at Tampa, Fla. [Mexico.] June-October.

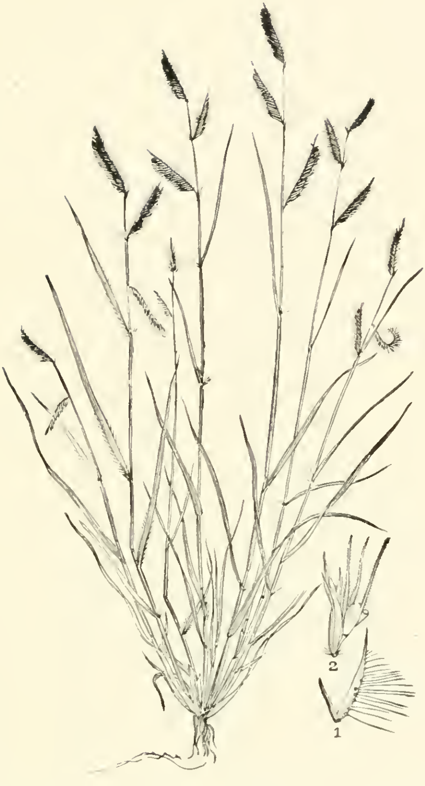


FIG. 205. **Bouteloua hirsuta** (HBK.) Lag. BRISTLY MESQUIT.—A cæspitose perennial 1.5 to 4 dm. high, with erect or ascending culms, flat leaves, and one to three more or less spreading, densely flowered spikes 2 to 4 cm. long.—Dry prairies and sandy plains, Illinois and Wisconsin to South Dakota, Nevada, Arizona, and Texas, and (?) southern Florida. [Mexico and Lower California.] July–September.

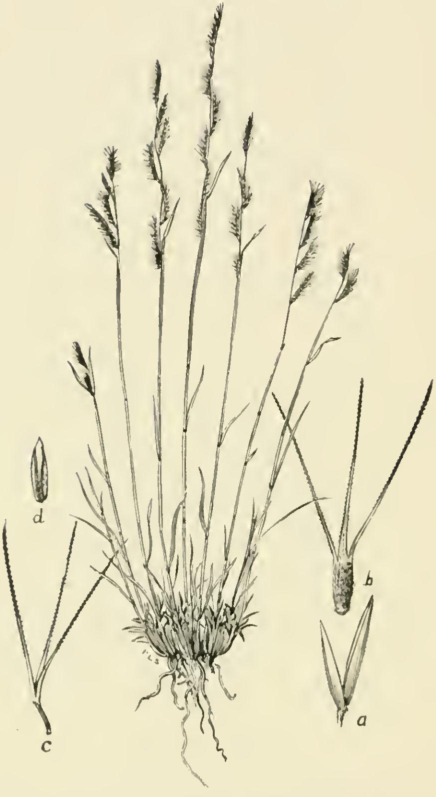


FIG. 206. **Bouteloua trifida** Thurb.; Beal, Grasses N. Am., **2**: 421. SMALL GRAMA.—A delicate perennial 1 to 3 dm. high, with short, narrow leaves, and three to seven ascending spikes usually about 2 cm. long.—Mesas and sandy plains, Texas to Arizona. [Northern Mexico.] May–October.

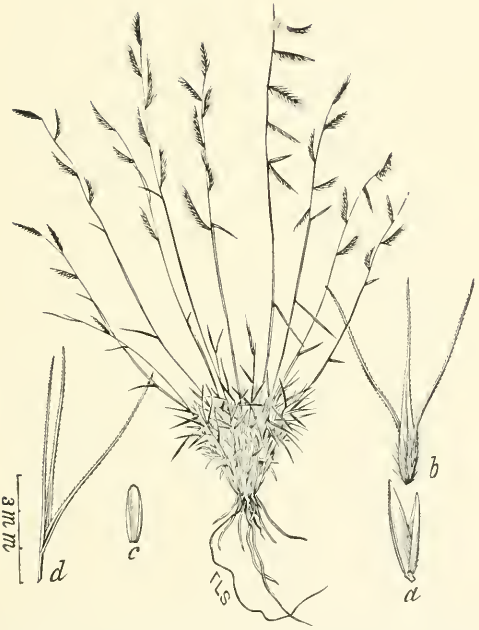


FIG. 207. **Bouteloua burkii** Scribn.: Beal, Grasses N. Am., **2**: 422. BURK'S GRAMA.—A slender, tufted perennial 15 (rarely 30) cm. high, with short, spreading leaves and slender, horizontal spikes 1 to 2 cm. long.—Sandy plains and dry mesas, western Texas. [Northern Mexico.] April–July.

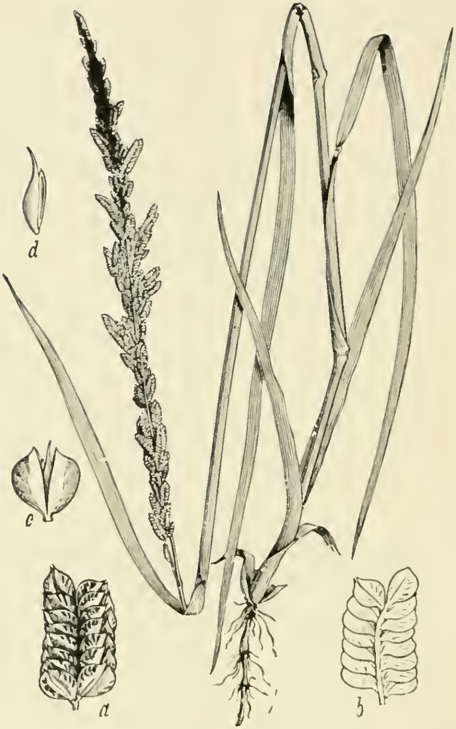


FIG. 208. **Beckmannia erucæformis** (L.) Host (*Phalaris erucæformis* Linn.). SLOUGH-GRASS.—A stout, erect, subaquatic perennial 3 to 12 dm. high, with narrow panicles composed of many, densely flowered one-sided spikes.—In sloughs and along the banks of rivers and streams, western Ontario to Iowa, California, British Columbia, and Alaska. [Europe and Asia.] June–September.

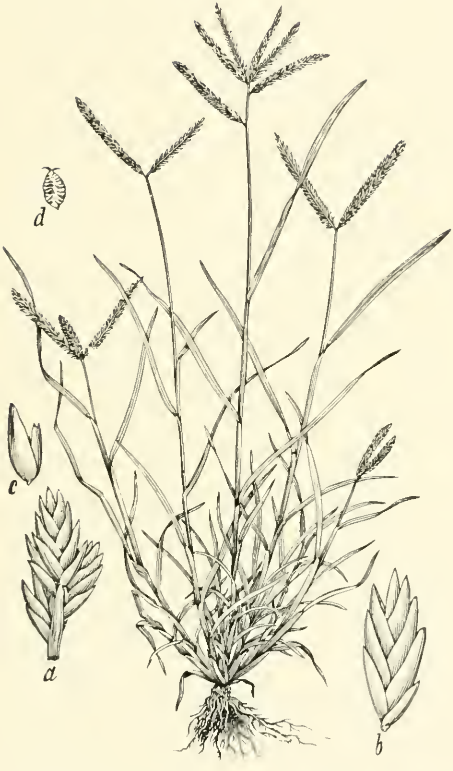


FIG. 209. **Eleusine indica (L.)** Gaertn. GOOSE or YARD-GRASS.—A coarse, tufted annual, with erect or spreading stems 1.5 to 6 dm. high, and two to five digitate spikes 5 to 7 cm. long.—Waste or cultivated ground, New Jersey to Ohio and Kansas, south to Florida and Texas. [Widely distributed in tropical and subtropical countries.] June-October.

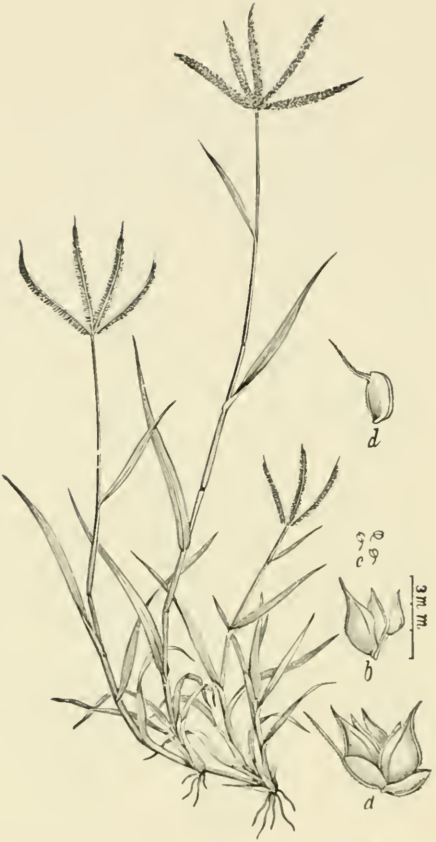


Fig. 210. **Dactyloctenium ægyptium** (L.) Willd. (*Cynosurus ægyptius* L.; *Dactyloctenium ægyptiacum* Willd.). Crowfoot-grass.—A low, tufted or creeping grass, with ascending flowering stems rarely 3 dm. high, and three to five digitate spikes 2 to 5 cm. long.—Waste or cultivated ground, southern New York to Illinois, south to Florida and Texas, west to California. [Widely distributed in tropical and subtropical regions of both hemispheres.] May–December.

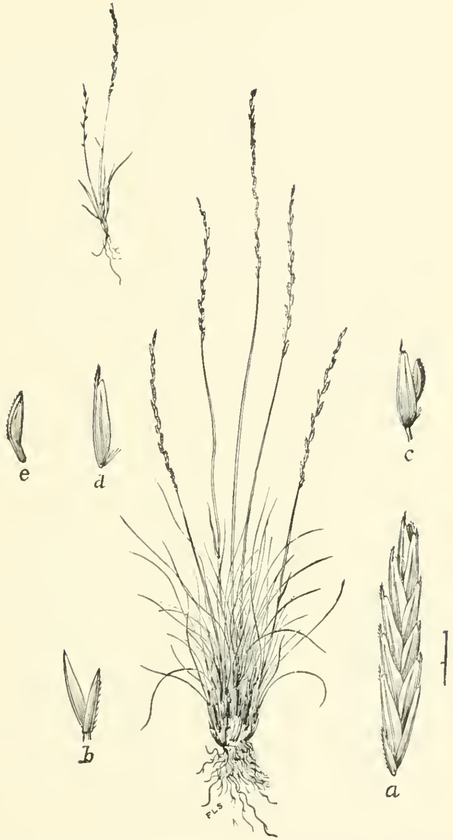


FIG. 211. **Leptochloa spicata** (Nees) Scribn. (*Bromus spicatus* Nees; *Diplachne spicata* Doell; *D. reverchoni* Vasey); Beal, Grasses N. Am., **2**: 434.—A low, densely cæspitose perennial (?), with numerous setaceous basal leaves and a slender, scape-like culm 6 to 15 cm. high.—Granitic rocks, central Texas. [Mexico and Brazil.] May–July.

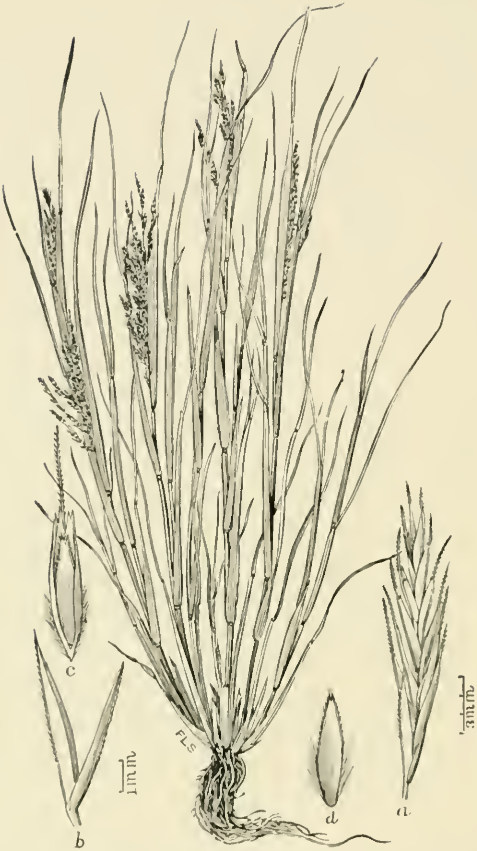


FIG. 212. **Leptochloa fascicularis** (Lam.) A. Gray. CLUSTERED SALT-GRASS.—An erect, ascending or more or less diffusely spreading, caespitose, much-branched annual 5 to 6 dm. high, with numerous, erect, crowded spikes 6 to 8 cm. long.—Salt marshes along the coast, Rhode Island to Texas; saline soil in the interior, western New York to South Dakota, Nevada, New Mexico, and Texas. [Mexico and West Indies.] July–September.

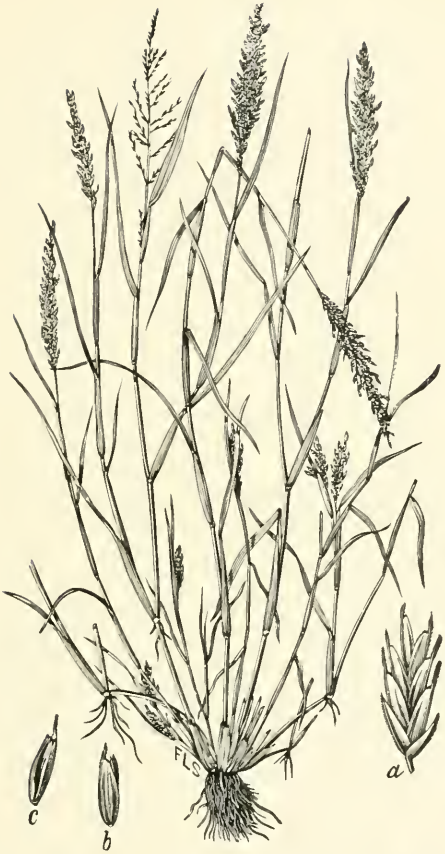


FIG. 213. **Leptochloa viscida** (Scribn.) Beal (*Diplachne viscida* Scribn.). VISCID LEPTOCHLOA.—A densely cæspitose and diffusely branched perennial (?) 0.5 to 3 (rarely 6) dm. high, with acute, flat leaves, and narrow, densely flowered panicles, composed of eight to twelve erect spikes.—Wet, clayey soil, New Mexico and Arizona. [Mexico and Lower California.] June–September.

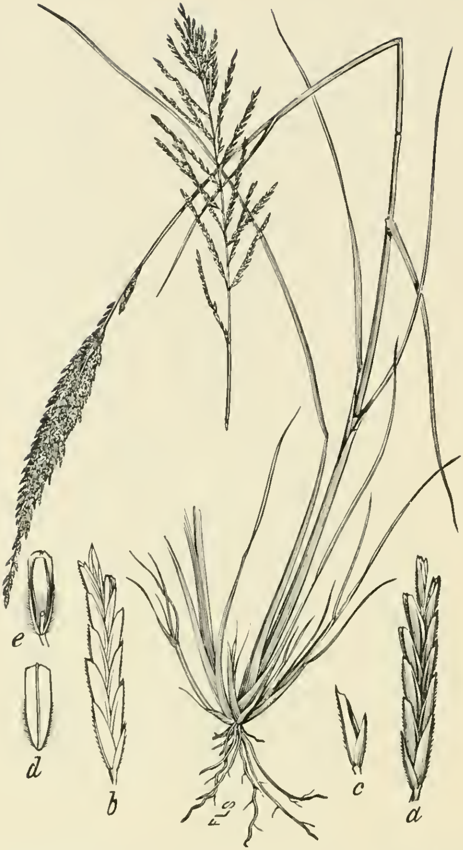


FIG. 214. **Leptochloa imbricata** Thurb. (*Diplachne imbricata* Scribn.); Beal, Grasses N. Am., **2**: 435.—A rather stout, erect or ascending perennial 3 to 9 dm. high, with smooth, usually glaucous culms, narrow, flat leaves, and numerous crowded, erect or ascending spikes 4 to 6 cm. long.—Texas to southern California. [Mexico and Lower California.] August–November.

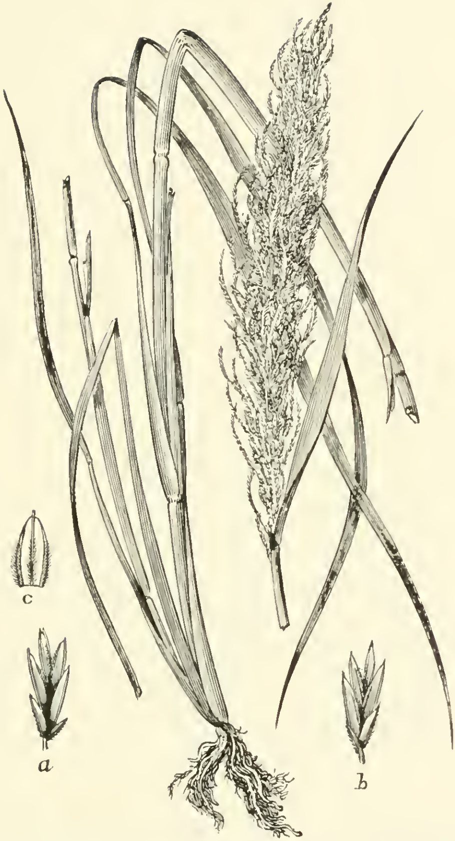


FIG. 215. **Leptochloa scabra** Nees (*L. langloisii* Vasey). ROUGH LEPTOCHLOA.—A stout annual 6 to 12 dm. high, with flat leaves and very many, crowded, slender spikes in terminal panicles 3 dm. long.—Ditches and fields, Louisiana. [Brazil.] September.

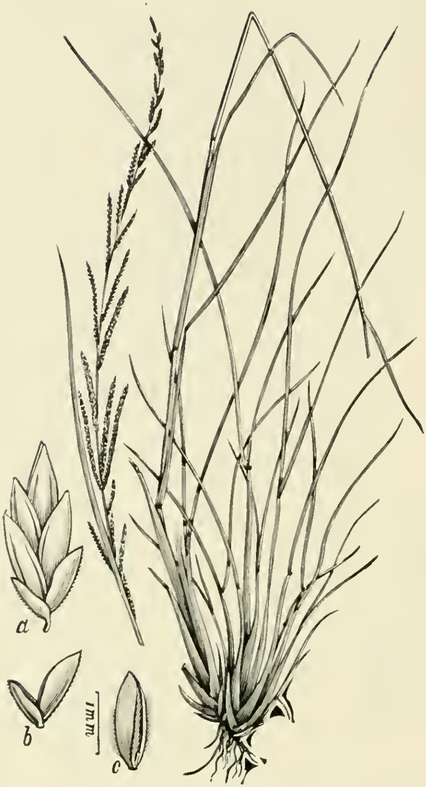


Fig. 216. **Leptochloa nealleyi** Vasey (*L. stricta* Fourn.). Nealley's Leptochloa.—A slender, or rather stout perennial, with erect or ascending culms 4.5 to 12 dm. high, and narrow, elongated panicles of many erect or ascending spikes.—Western Texas. [Mexico.] April–June.

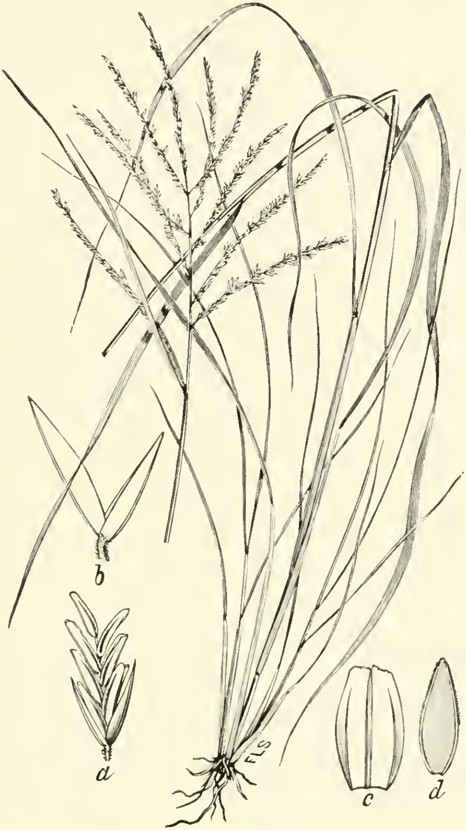


FIG. 217. **Leptochloa dubia** (HBK.) Nees (*Chloris dubia* HBK.; *Diplachne dubia* Scribn.); Beal, Grasses N. Am., **2**: 437.—A rather stout and apparently perennial species, 3 to 9 dm. high, with usually eight to ten approximate spreading spikes 6 to 8 cm. long.—Southern Florida, Texas to Arizona, and southward into Mexico. April–September.

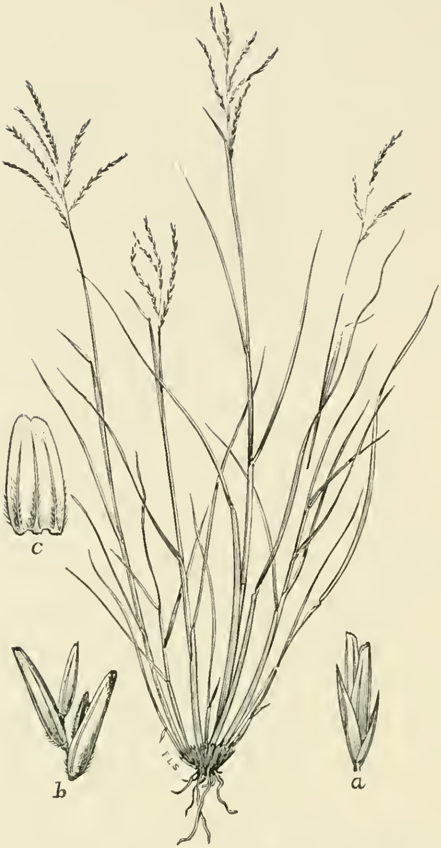


FIG. 218. **Leptochloa pringlei** (Vasey) Beal, Grasses N. Am., **2**: 436.—A rather slender perennial 2.5 to 3.5 dm. high, with narrow leaves and four to six spikes 2.5 to 5 cm. long, approximate near the summit of the culm. Spikelets two- to three-flowered.—Arizona. April, May.

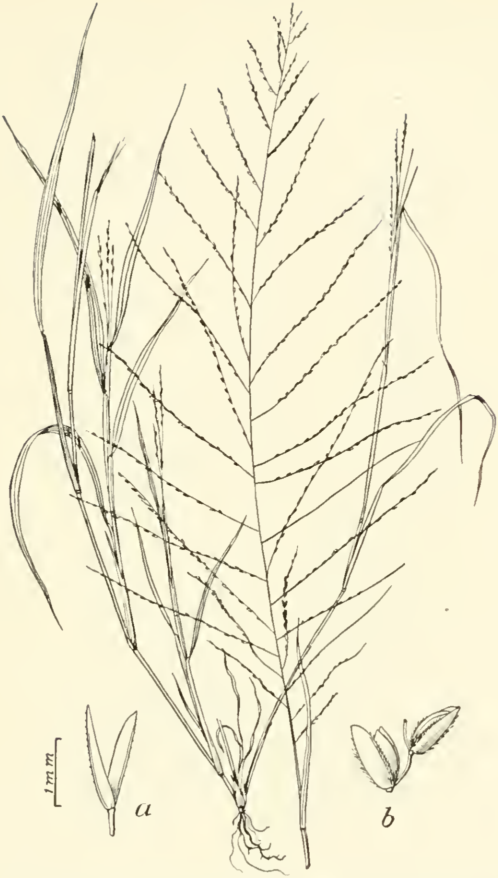


FIG. 219. **Leptochloa mucronata** (Michx.) Kunth. FEATHER-GRASS.—A more or less branching annual 6 to 12 dm. high, with rather broad, flat leaves and long terminal panicles of many slender spikes.—A weed in cultivated and waste grounds, Virginia, Illinois, Missouri, Tennessee, Alabama, Texas, Indian Territory, Arizona, and California. [Northern Mexico and Cuba.] June-October.

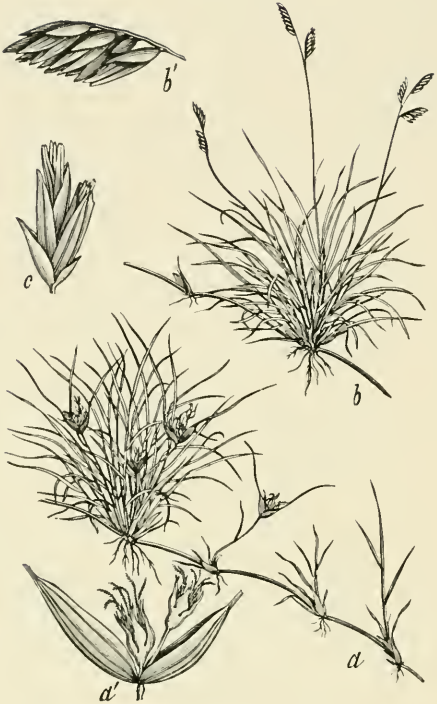


Fig. 220. **Bulbilis dactyloides** (Nutt.) Raf. (*Buchloë dactyloides* Engelm.); Britton and Brown, Ill. Fl., **1** : 183. BUFFALO-GRASS.—A low, fine-leafed, and extensively creeping perennial, rarely more than 1 to 1.5 dm. high. Similar to Bermuda in habit of growth.—Dry prairies and river bottoms, Minnesota and South Dakota (ascends to 1,650 m. in Black Hills), to Arkansas, southern Texas, and Colorado. [Mexico.] March–August.

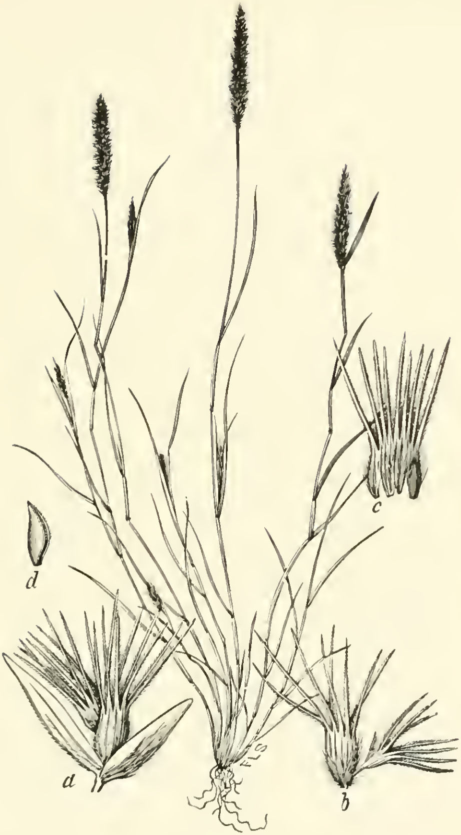


Fig. 221. **Pappophorum wrightii** S. Wats. (*P. boreale* Torr., not Griseb.); Beal, Grasses N. Am., **2**: 448. Purple-grass.—A slender, branching and apparently annual species 2 to 4 dm. high, with narrow, involute leaves and densely flowered, spike-like, lead-colored or purplish panicles 1 to 7 cm. long.—Rocky hills, canyons, and open plains, western Texas to Arizona. [Northern Mexico.] July–September.

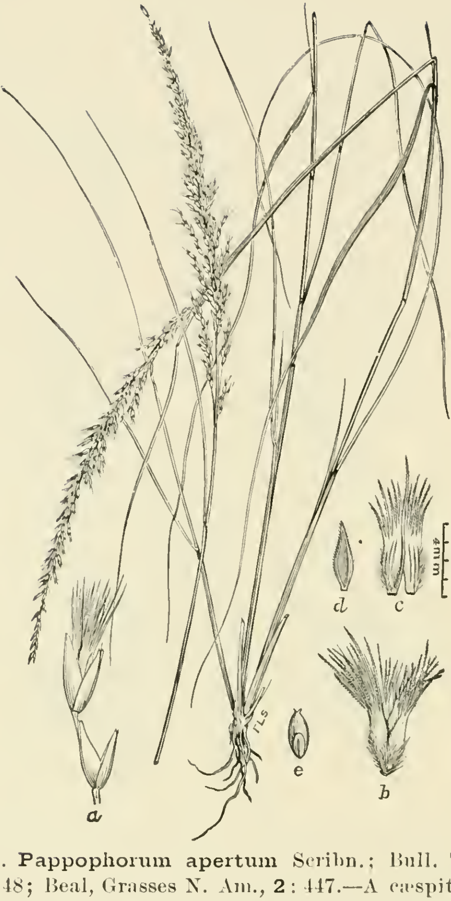


FIG. 222. **Pappophorum apertum** Scribn.; Bull. Torr. Bot. Club, **9**: 148; Beal, Grasses N. Am., **2**: 447.—A cæspitose perennial 3 to 8 dm. high, with long, narrow, mostly involute leaves and narrow, pale, or often straw-colored panicles 15 to 20 cm. long.—Valleys, western Texas to Arizona and Mexico. June.

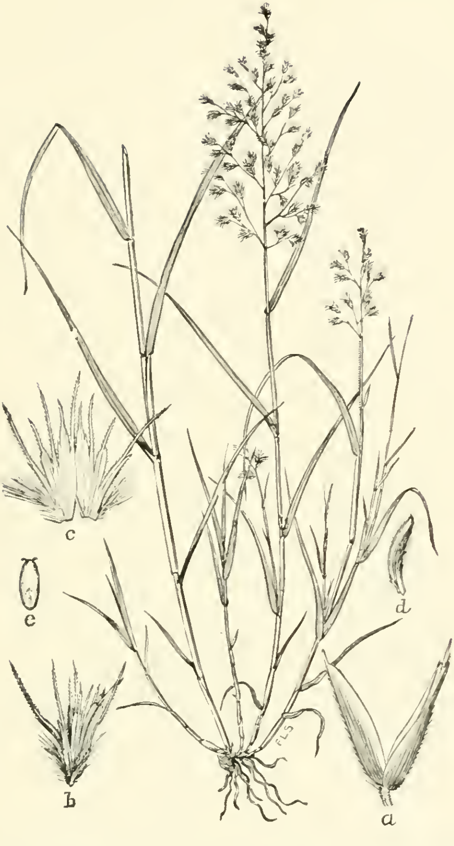


FIG. 223. **Cottea pappophoroides** Kth. COTTA-GRASS.—An erect, branching perennial 3 to 6 dm. high, with narrow, flat, pilose leaves and oblong, open panicles 9 to 18 cm. long: spikelets two- to six-flowered, floral glumes many-parted.—In canyons, western Texas to Arizona. [Mexico and South America.] August–October.

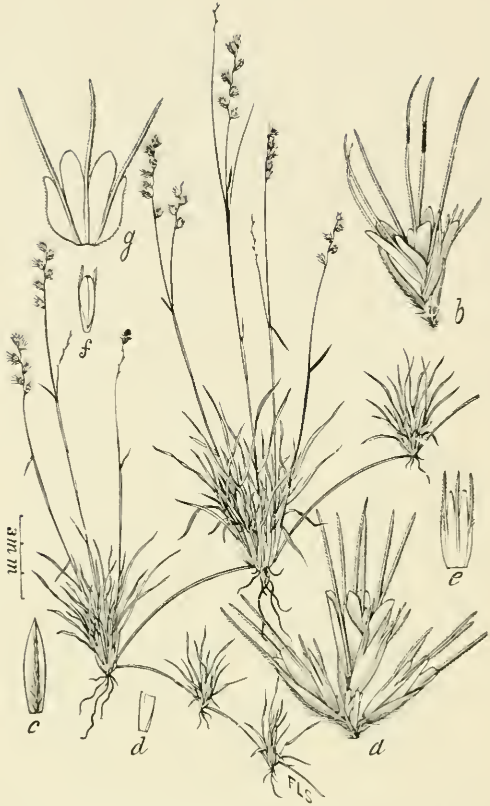


FIG. 224. **Cathestecum prostratum** Presl (*C. erectum* Vasey and Hack.); Beal, Grasses N. Am., **2** : 452.—An extensively creeping, slender perennial, with upright flowering branches 1 to 3 dm. high, narrow, flat leaves, and clustered spikelets in terminal or lateral racemes.—Dry mesas and bluffs along the Rio Grande, western Texas. [Mexico.] July–October.

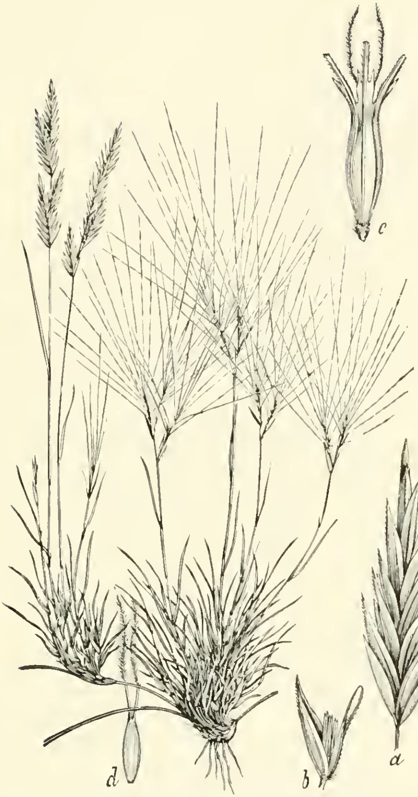


FIG. 225. **Scleropogon brevifolius** Philippi (*Tricuspis monstrosa* Munro; *Lesourdia multiflora* and *L. karwinskyana* Fourn.).—A wiry, creeping perennial with densely tufted, upright, leafy branches 1 to 2.5 cm. high, and unisexual spikelets: the pistillate long-awned, the staminate awnless.—Dry mesas and canyons, Colorado to Texas, New Mexico, Arizona, and southward into Mexico and South America. May–October.

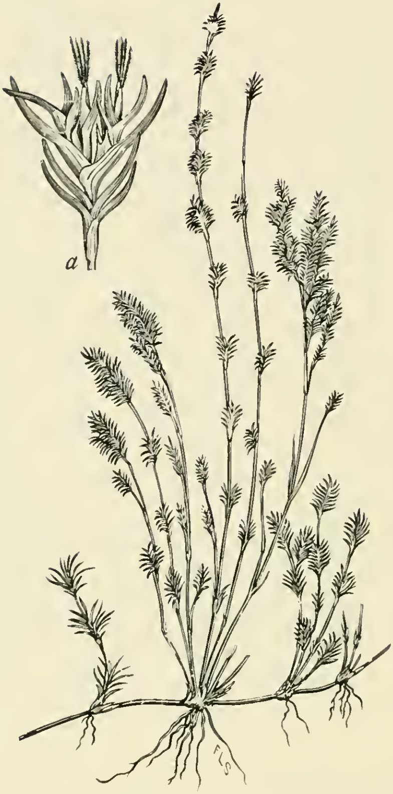


FIG. 226. **Monanthochloe littoralis** Engelm. SALT CEDAR.—A creeping grass, with hard, woody stems, and crowded, subulate, rigid leaves 2 cm. long or less.—Rocky shores and salt marshes along the coast, southern Florida, extreme southern Texas, southern California. [Lower California.] May, June.

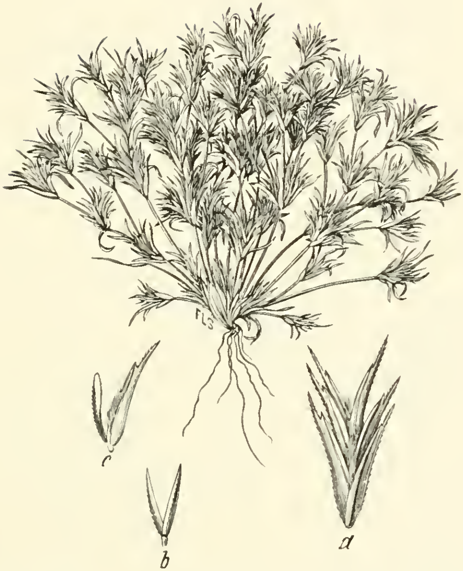


Fig. 227. **Munroa squarrosa** (Nutt.) Torr. False Buffalo-grass.—A low, diffusely much-branched annual, with crowded and sharply pointed, rigid leaves 0.5 to 2.5 cm. long.—Prairies and dry plains, South Dakota to Texas, west to Alberta, Montana, Colorado, and Arizona. June-October.

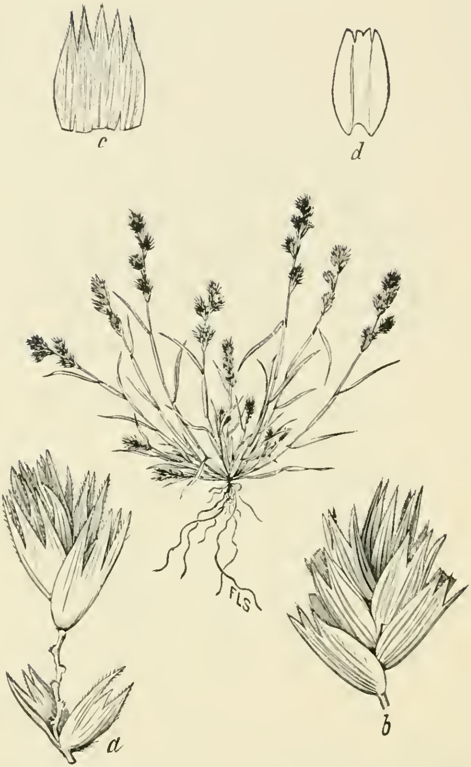


FIG. 228. **Orcuttia californica** Vasey; Beal, Grasses N. Am., **2**: 457.—A low, much-branched, cæspitose annual 0.5 to 1 dm. high, the numerous stems bearing three to six spikelets near the apex.—Southern and Lower California. April.

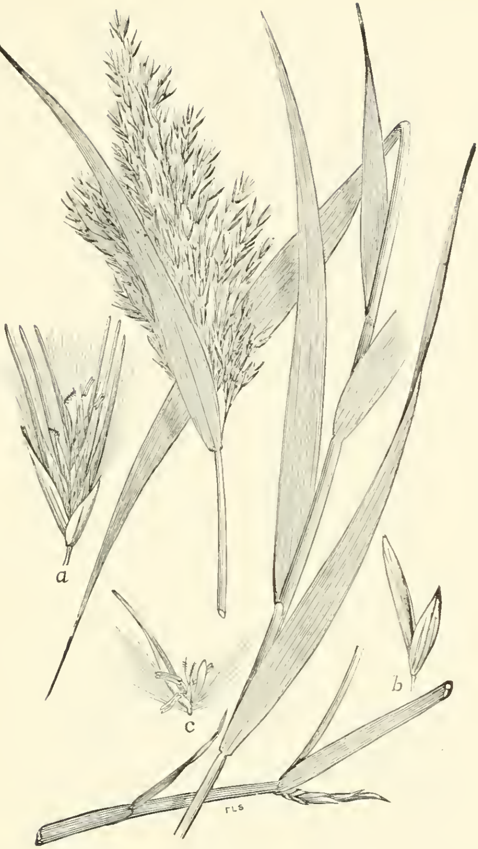


FIG. 229. **Phragmites vulgaris** (Lam.) B. S. P. (*P. communis* Trin.; *Arundo vulgaris* Lam.; *A. phragmites* L.). COMMON REED.—A tall, stout, perennial grass, with stout, creeping rootstocks, numerous broad, attenuate-pointed leaves, and a large ovoid-pyramidal, purplish, terminal panicle.—Margins of lakes and rivers and in brackish coast marshes, almost everywhere in the United States and southern British America. [Widely distributed in temperate regions of both hemispheres.] August–October.

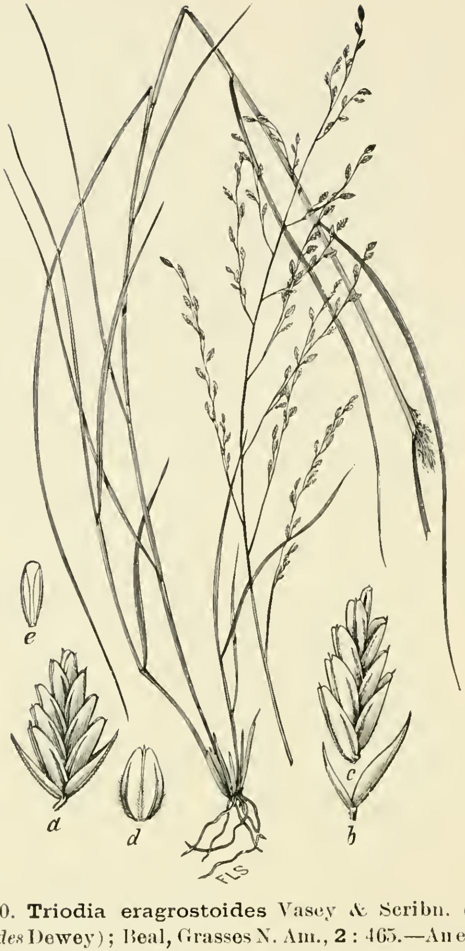


Fig. 230. **Triodia eragrostoides** Vasey & Scribn. (*Sieglingia eragrostoides* Dewey); Beal, Grasses N. Am., **2**: 465.—An erect, leafy perennial 6 to 9 dm. high, with long, narrow leaves and open, small-flowered panicles 2 to 3 dm. long.—Rocky banks, etc., southern Texas, southern Florida. [Northeastern Mexico.] June-October.

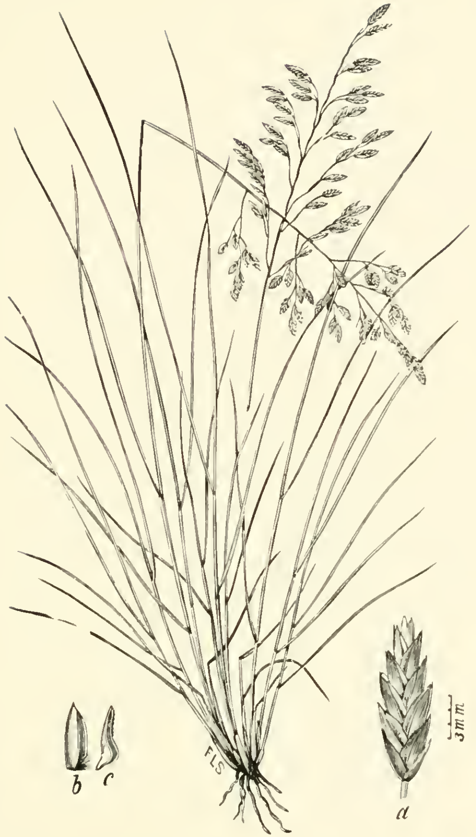


Fig. 231. **Triodia texana** S. Wats.; Beal, Grasses N. Am., **2**: 466.—A slender, wiry grass 3 to 6 dm. high, with very narrow leaves and loosely few-flowered, nodding panicles 10 to 15 cm. long.—Rich valley land, dry places, etc., Louisiana and Texas to Arizona. [Northern Mexico.] June–August.

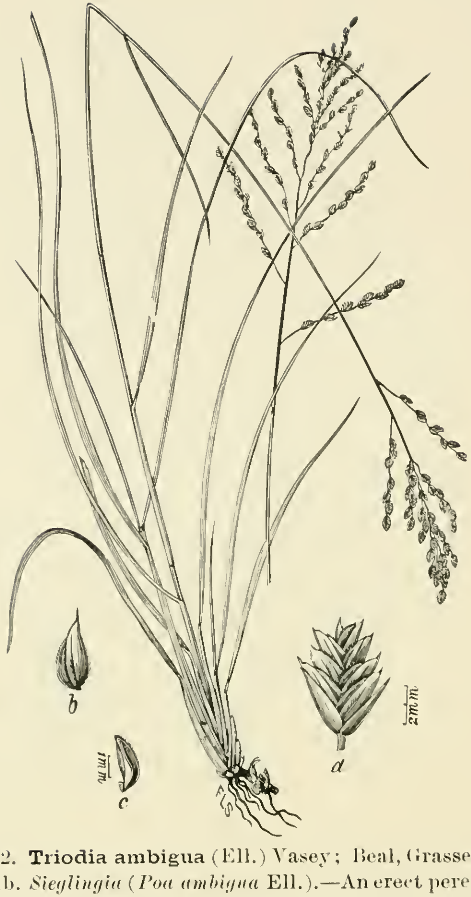


Fig. 232. **Triodia ambigua** (Ell.) Vasey; Beal, Grasses N. Am., **2**: 465, sub. *Sieglingia* (*Poa ambigua* Ell.).—An erect perennial 6 to 12 dm. high, with narrow, flat leaves and open, pyramidal panicles 10 to 20 cm. long.—Dry, open, pine barrens near the coast, South Carolina to Texas. July–October.

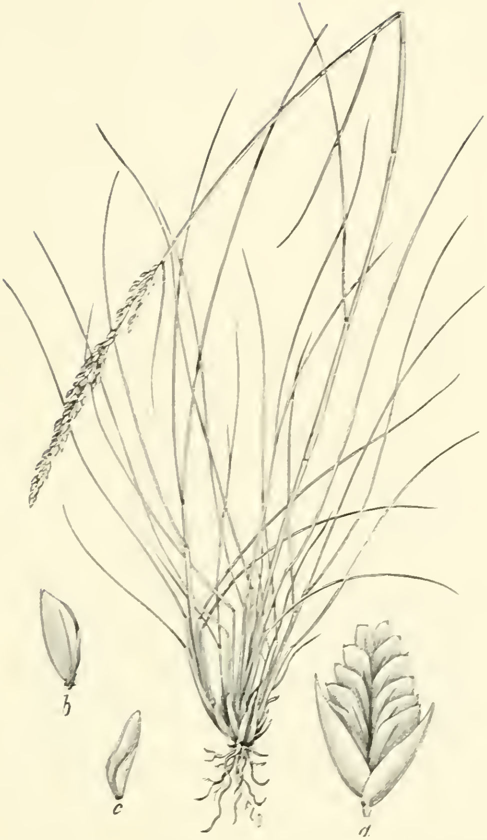


Fig. 233. **Triodia albescens** (Munro) Vasey (*Sieglingia albescens* Kuntze); Beal, Grasses N. Am., **2**: 469.—A cæspitose, erect perennial 4 to 7 dm. high, with narrow, flat leaves and densely flowered, spike-like panicles 9 to 15 cm. long.—Texas. August–October.

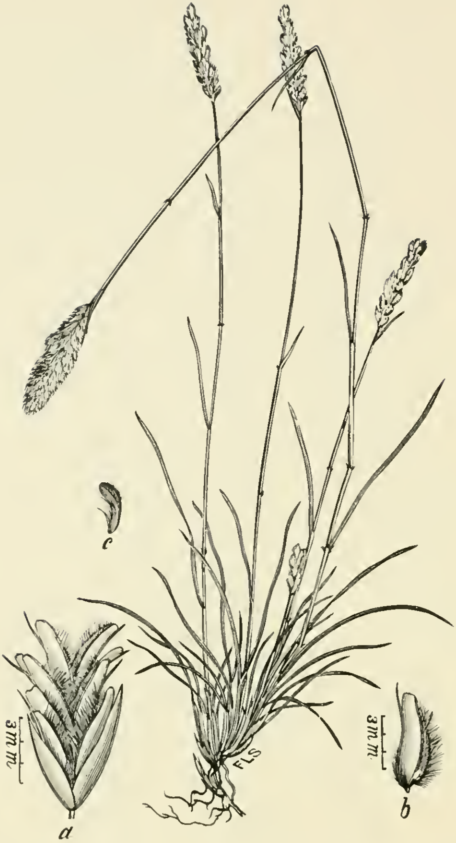


Fig. 234. **Triodia nealleyi** Vasey; Bull. Torr. Bot. Club., **15**: 49 (1888); (*Sieglingia nealleyi* Dewey; Beal, Grasses N. Am., **2**: 470).—A slender, glaucous, cæspitose perennial, 3 to 4 dm. high, with flat or conduplicate leaves, and densely flowered, linear or ovoid panicles 4 to 5 cm. long.—Canyons and ridges, southwestern Texas. September.

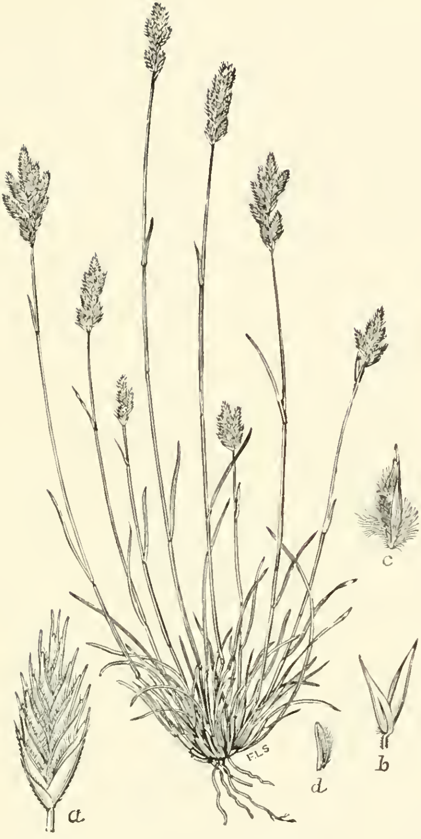


FIG. 235. **Triodia acuminata** (Munro) Vasey (*Sieglingia acuminata* Kuntze); Beal, Grasses N. Am., **2** : 470.—A slender, densely tufted perennial 1.5 to 2 dm. high, with short leaves, and simple, dense, oblong panicles 1.5 to 3 cm. long. – Poor, gravelly soil, hillsides, etc., Texas to Arizona, north to Colorado and Indian Territory. [Northern Mexico.] April-June.

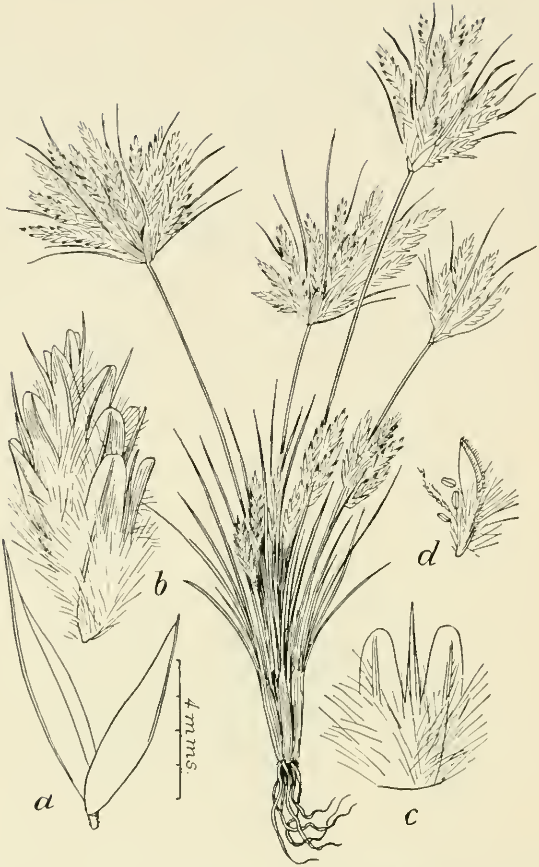


FIG. 236. **Triodia pulchella** HBK. (*Sieglingia pulchella* Kuntze); Beal, Grasses N. Am., **2**: 468.—A low, densely tufted and often creeping perennial 2 to 15 cm. high, with very narrow leaves and crowded spikelets in clusters of three to six, which are equaled or exceeded by the upper leaves.—Western Texas to Nevada and southern California. [Northern Mexico.] February–June.

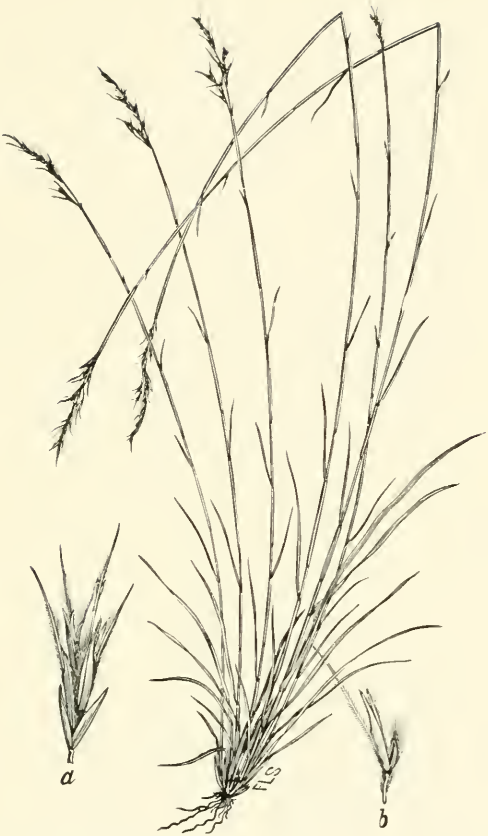


FIG. 237. **Triplasis americana** Beauv. (*Sieglingia americana* Beal, Grasses N. Am., **2** : 466).—A slender, cæspitose grass, with wiry culms 4 to 9 dm. high, rather short, narrow leaves, and few-flowered, simple panicles 3 to 10 cm. long; the pubescent awns 5 to 7 mm. long.—Dry, sandy soil near the coast, North Carolina to Mississippi. July–October.

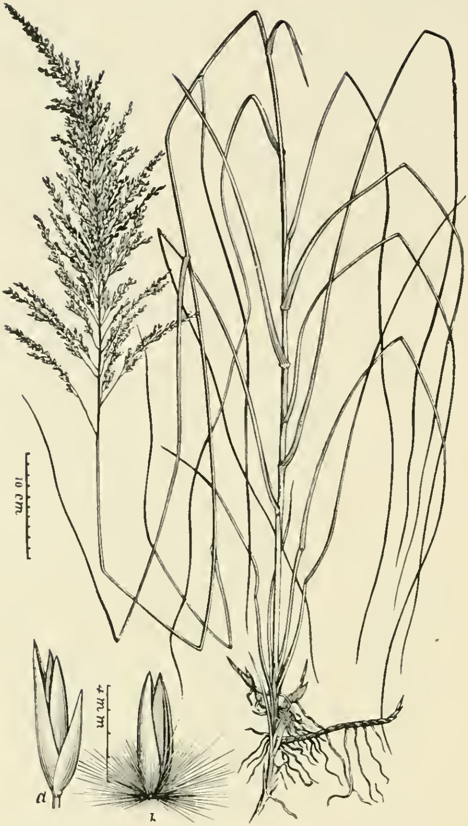


Fig. 238. **Redfieldia flexuosa** (Thurb.) Vasey (*Graphephorum* (?) *flexuosum* Thurb.); Britton and Brown, Ill. Fl., **1**: 186. Redfield's-grass.—A stout, native perennial 6 to 12 dm. high, with very long, narrow leaves and diffuse, capillary panicles 25 to 60 cm. long.—Sand hills and "blow-outs," Kansas and Nebraska to Indian Territory, Colorado, and Wyoming. July, August.

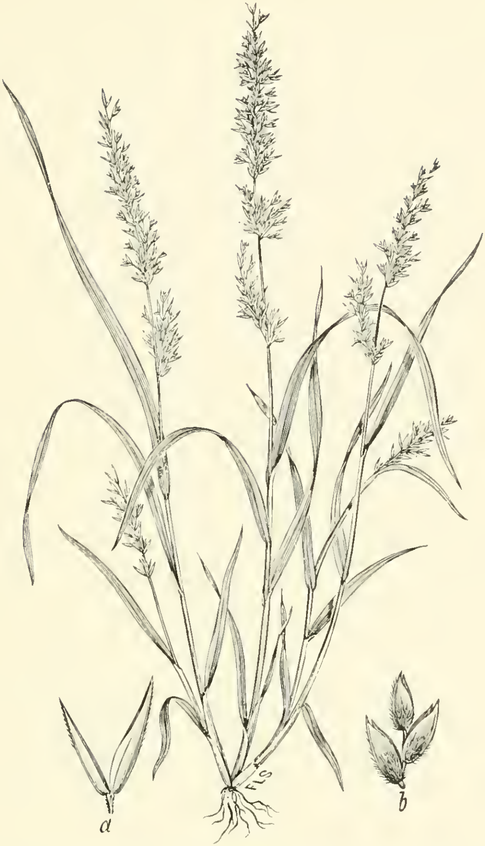


FIG. 239. **Dissanthelium californicum** (Nutt.) Benth.; Beal, Grasses N. Am., **2** : 473 (*Stenochloa californica* Nutt.).—A slender, glabrous, branching annual 1 to 3 dm. high, with short, narrow leaves and contracted, spike-like panicles 4 to 8 cm. long.—Santa Catalina Island, southern California, and Guadaloupe Islands, Lower California. September.

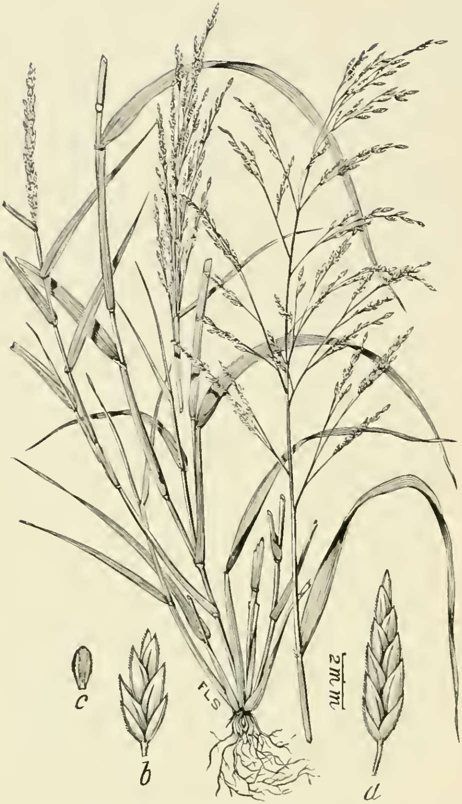


FIG. 240. **Eragrostis neo-mexicana** Vasey; Beal, Grasses N. Am., **2**: 485. CRAB-GRASS (in New Mexico).—A rather stout, branching and leafy annual 3 to 12 dm. high, with flat leaves and ample, diffuse panicles 20 to 40 cm. long.—Texas to southern California (ascends to 1,500 m. in Arizona). August. A valuable hay grass resembling Teff (*E. abyssinica*).

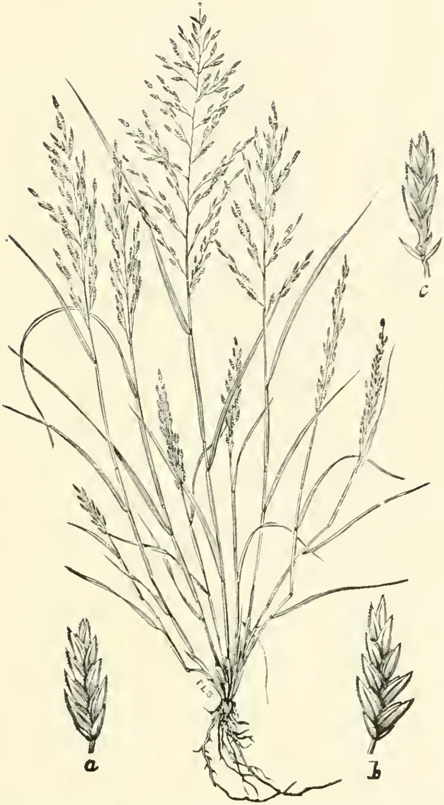


FIG. 241. **Eragrostis purshii** Schrad. SOUTHERN SPEARGRASS.—An annual, 1 to 4 dm. high, with the erect or ascending culms diffusely branching near the base, and diffuse panicles of small, spreading spikelets.—Sandy river banks, waste ground, etc., Massachusetts and Ontario to South Dakota and California, south to Florida, Texas, and Arizona. [Mexico.] June-October.

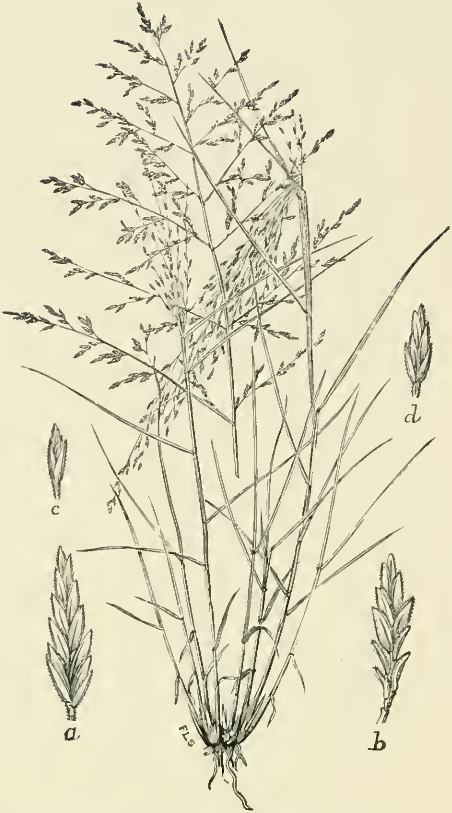


FIG. 242. **Eragrostis curtipedicellata** Buckl.; Britton and Brown, Ill. Fl., **1**: 190. SHORT-STALKED ERAGROSTIS.—A rather rigid, branching perennial 3 to 9 dm. high, with flat, spreading leaves and diffuse panicles 20 to 30 cm. long. Related to *E. pectinacea*.—Prairies, Kansas, Indian Territory, and Texas. July–September.

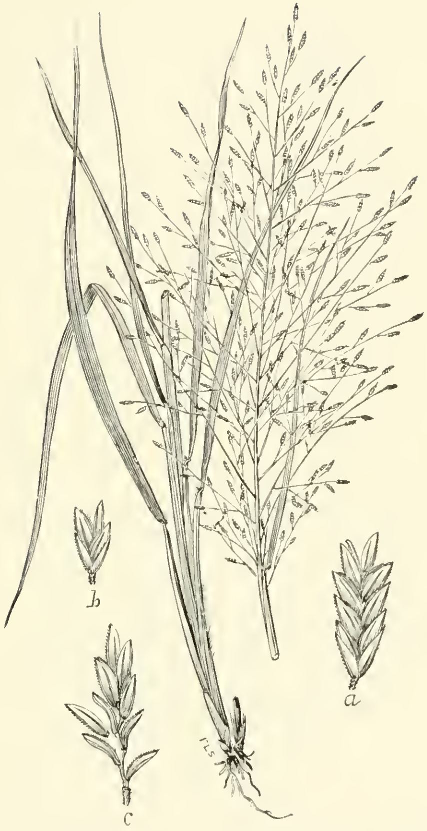


FIG. 243. **Eragrostis pectinacea** (Michx.) Steud.—An erect, cæspitose perennial 3 to 9 dm. high, with a short, stout rootstock and large, spreading, red-purple panicles.—Dry, sandy soil in the open, Massachusetts to South Dakota and Colorado, south to Florida and Texas. July–October.

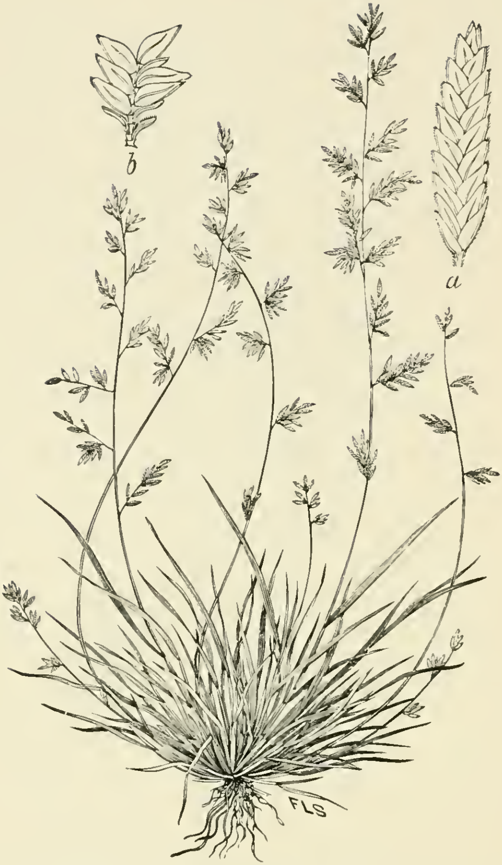


FIG. 244. **Eragrostis brownei** Nees (?).—A widely spreading, branching perennial, with somewhat wiry culms 2 to 5 dm. long, and narrow, simple, more or less interrupted panicles of nearly sessile, ten- to forty-flowered spikelets.—Dooryards and waste ground, Florida. [Widely distributed in tropical and subtropical regions.] July–October.

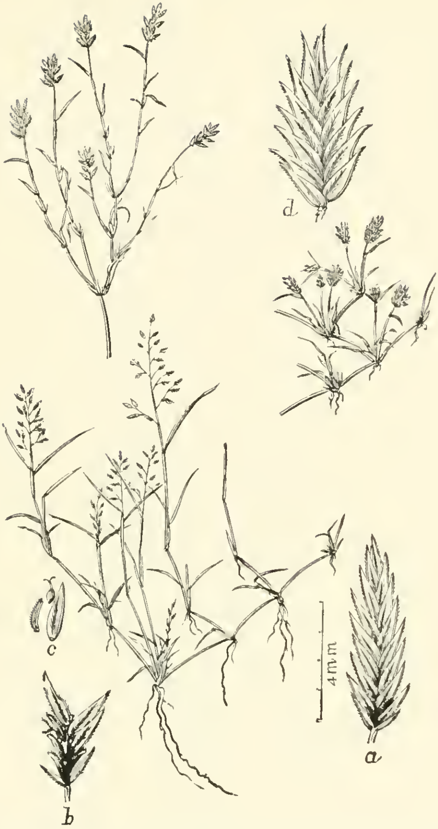


FIG. 245. **Eragrostis hypnoides** (Lam.) B. S. P. (*Poa hypnoides* Lam.; *E. reptans* Nees).—A prostrate, much-branched, and extensively creeping annual, with ascending, flowering branches 7.5 to 15 cm. high, spreading leaf blades, narrow and lax or very dense panicles and long, linear-lanceolate, strongly compressed spikelets.—In ditches and sandy banks of streams, Vermont and Ontario to Florida, Texas, California, and Washington. [Mexico, West Indies, and South America.] March–October.

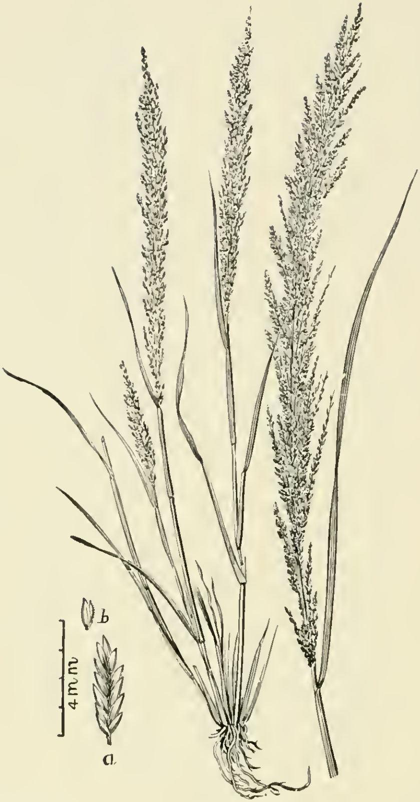


FIG. 246. **Eragrostis glomerata** (Walt.) L. H. Dewey (*Poa glomerata* Walt.; *P. conferta* Ell.: *Eragrostis conferta* Trin.).—An erect, rather stout, branching annual 6 to 9 dm. high, with smooth sheaths and leaves, and elongated, densely flowered, light-colored panicles 25 to 60 cm. long.—Low grounds, South Carolina to Florida and westward to Texas. [Cuba, Mexico, and South America.] August–November.

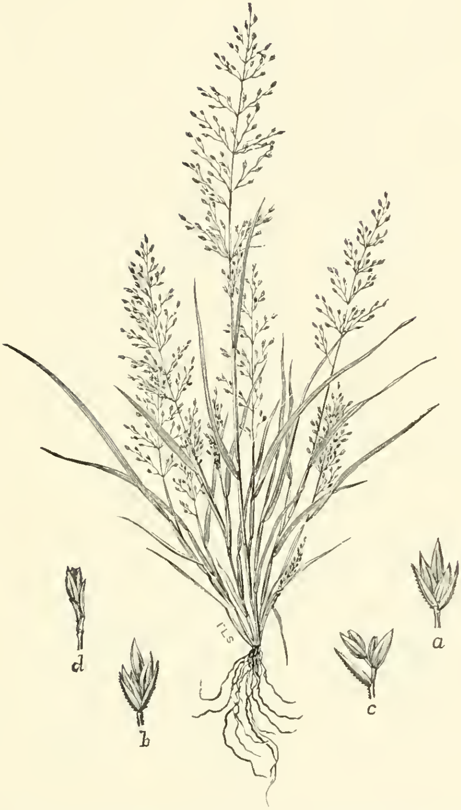


FIG. 247. **Eragrostis frankii** Steud. SHORT-STALKED MEADOW-GRASS.—A low, diffusely branched annual 0.8 to 1.5 dm. high, with open, many-flowered panicles 5 to 12 cm. long.—Low, sandy ground in the open, southern New York to Minnesota, south to Georgia, Louisiana, and Kansas. August-October.

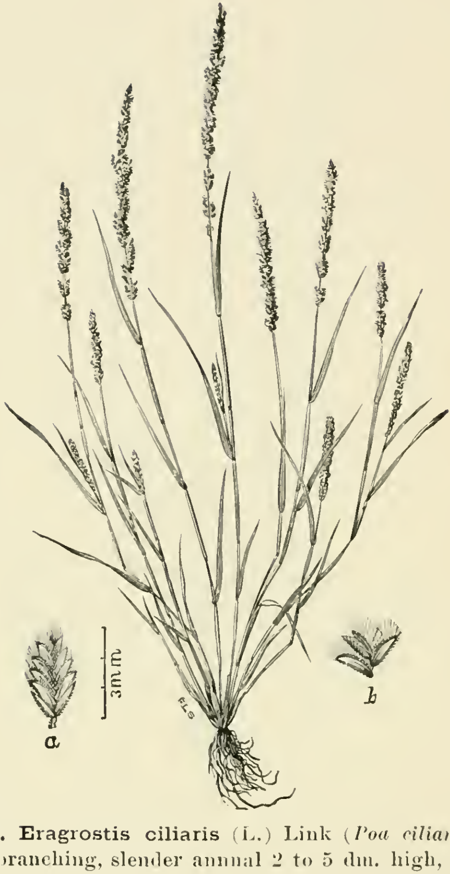


FIG. 248. **Eragrostis ciliaris** (L.) Link (*Poa ciliaris* L.).—A diffusely branching, slender annual 2 to 5 dm. high, with thin, narrow leaves and densely flowered, cylindrical, spike-like, more or less interrupted panicles 5 to 10 cm. long.—Cultivated and waste ground, Georgia and Florida to Mississippi. [Mexico, West Indies, and Asia.] July-October.

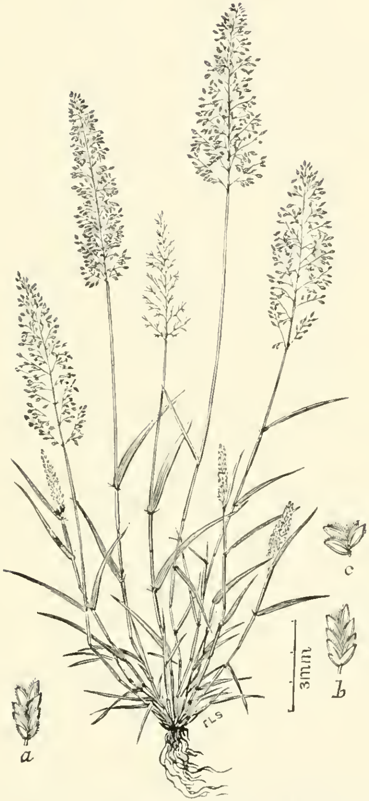


FIG. 249. **Eragrostis plumosa** Link. (*E. ciliaris patens* Chapm.).— A slender, diffusely branching annual 1 to 4 dm. high, with flat leaves and oblong, open panicles 5 to 15 cm. long.—Cultivated and waste ground, southern Georgia and Florida. [Widely distributed in tropical countries.] July–November.

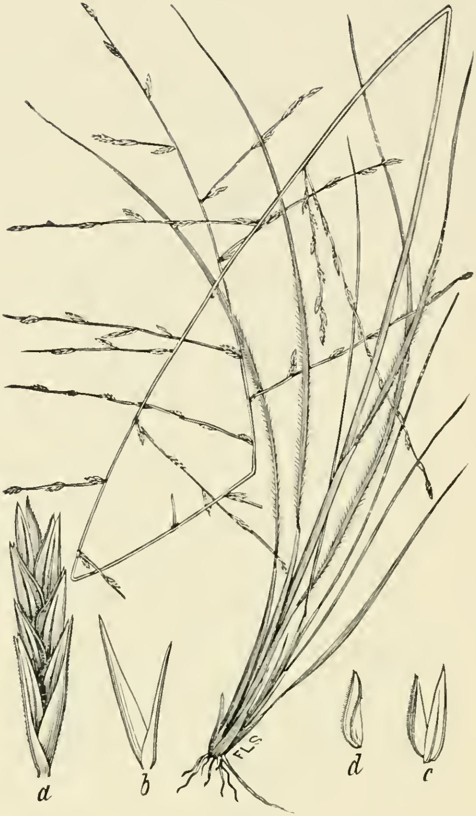


FIG. 250. **Eragrostis sessilispica** Buckl.; Britton and Brown, Ill. Fl., **1** : 190 (*Diplachne rigida* Vasey).—A smooth, wiry, cæspitose perennial 3 to 9 dm. high, with narrow, mostly involute leaves and pyramidal panicles, the five- to twelve-flowered, appressed spikelets sessile along the spreading branches.—Dry prairies, Kansas to Texas. June-October.

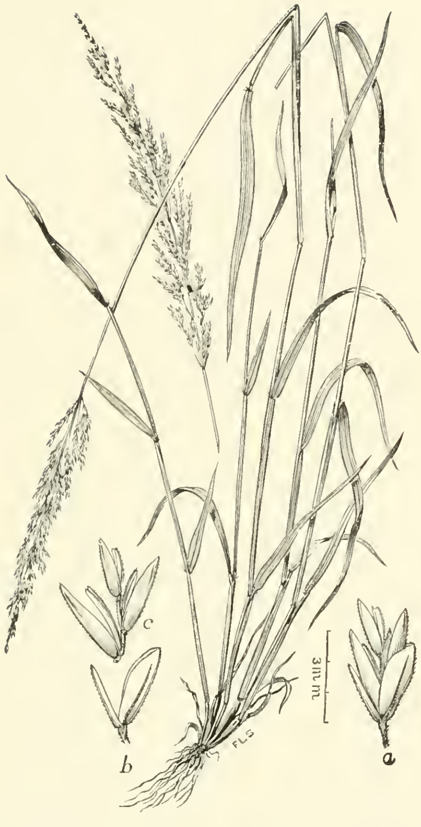


FIG. 251. **Eatonia pennsylvanica** (DC.) A. Gray. EATON'S-GRASS.—A slender, pale-green perennial, with flat leaf blades and narrow terminal panicles.—Wet meadows, low woods, and thickets, Newfoundland and Maine to British Columbia and Washington, south to Georgia, Mississippi, Texas, and Arizona. April-August.

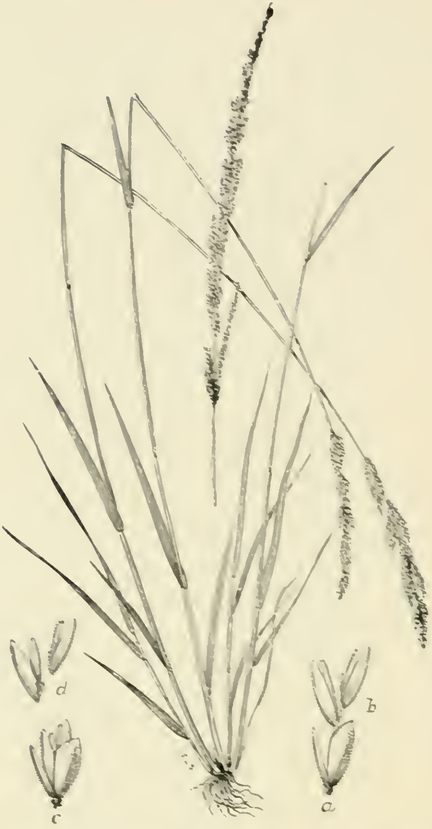


FIG. 252. **Eatonia obtusata** (Michx.) A. Gray. EARLY BUNCH-GRASS.—A tufted perennial 4.5 to 6 dm. high, with flat leaf blades and rather densely flowered, nodding panicles.—Low ground, chiefly along streams, usually in shade. Massachusetts and Ontario to Assiniboia and British Columbia, south to Florida, Texas, and southern California. March–August.

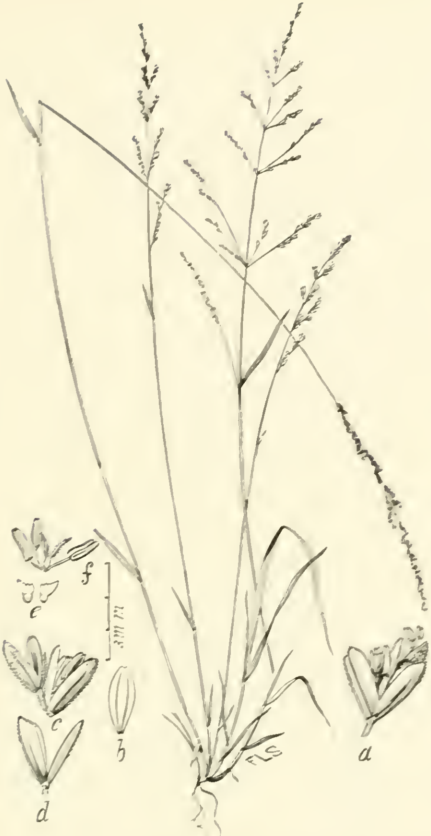


FIG. 253. **Eatonia nitida** (Sprengel) Nash (*Aira nitida* Spr.: *Eatonia dudleyi* Vasey).—A slender, erect, and cæspitose perennial 3 to 6 dm. high, with short, flat, spreading leaves and rather few-flowered, nodding panicles.—Dry, open woodlands, Rhode Island and New York westward to North Dakota, and southward to North Carolina, Mississippi and Texas. April–June.

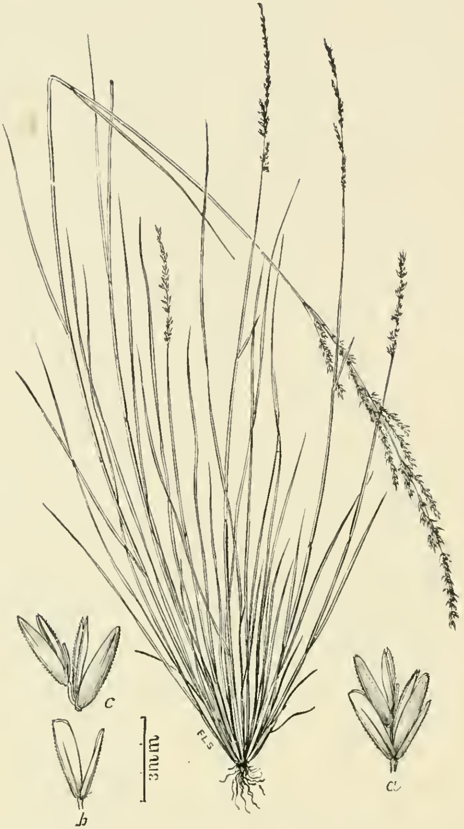


FIG. 254. **Eatonia filiformis** (Chapm.) Vasey; Beal, Grasses, N. Am., **2** : 491.—An erect, tufted perennial 3 to 6 dm. high, with very long upper internodes and long, involute, radical leaves.—Dry, sandy soil, South Carolina, Florida and Texas, north to western Tennessee. March, April.

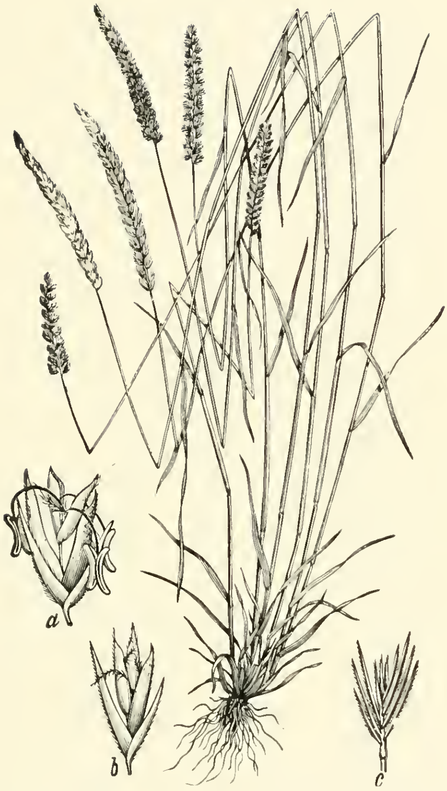


Fig. 255. **Cynosurus cristatus** L. Dog's-tail-grass.—A slender, erect perennial 3 to 7½ dm. high, with narrow leaves and rather slender, erect, spike-like panicles.—Sparingly established in fields and waysides, Newfoundland to Ontario, south to New Jersey; Portland, Oregon. [Europe.] June-August.

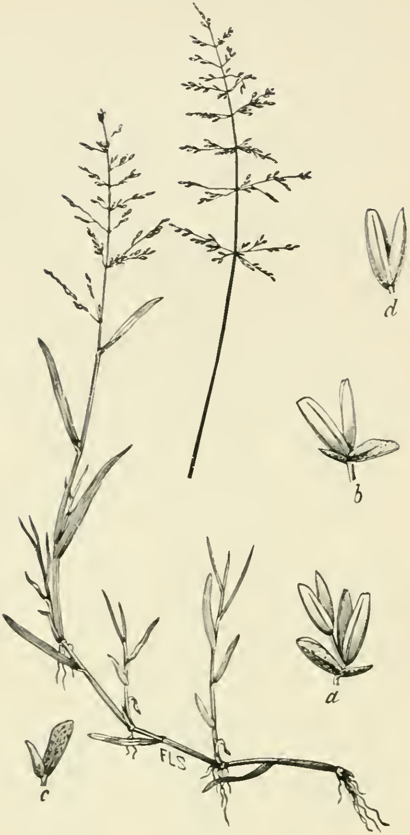


Fig. 256. **Catabrosa aquatica** (L.) Beauv.; Britton and Brown, Ill. Fl., **1**: 194. Water Whorl-grass.—A smooth, soft perennial, with creeping or ascending culms 2 to 6 dm. long, flat leaves and open panicles 5 to 20 cm. long, the spreading branches in whorls.—In swales and along brooks, often in shallow water, Newfoundland and Labrador, to Quebec and Alaska, south to Nebraska, Colorado, and Utah. [Europe and Asia.] June–August.

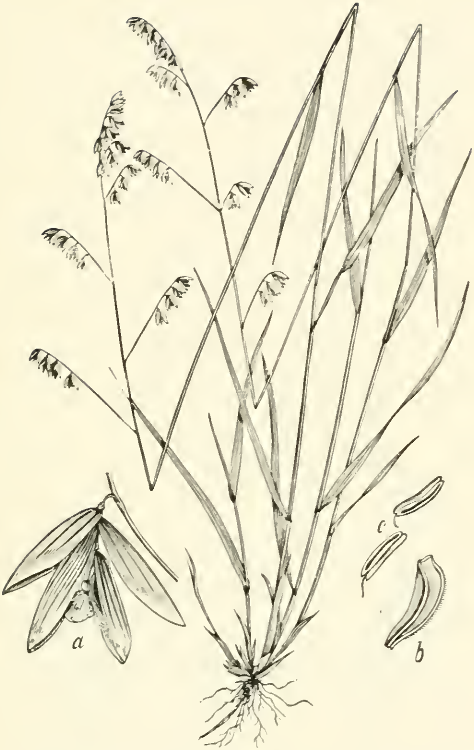


FIG. 257. **Melica mutica** Walt. (*M. glabra* Mx.).—A slender, loosely cæspitose, wiry grass 6 to 9 dm. high, with flat leaves and simple or racemose panicles of rather large, nodding, two- to three-flowered spikelets.—Dry, rocky, open woods and thickets, Pennsylvania to Florida and westward to Wisconsin and Texas. March-May.

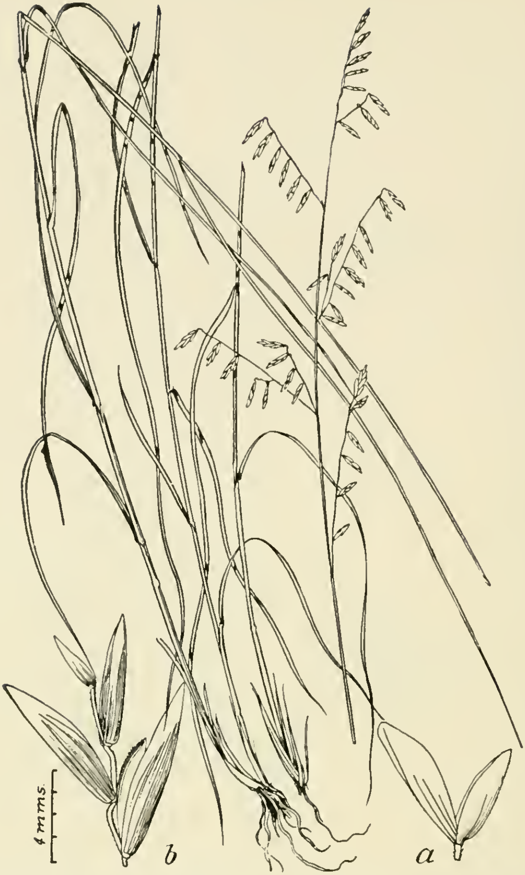


FIG. 258. **Melica parviflora** (Porter) Scribn. (*M. mutica parviflora* Porter; *M.porteri*, Scribn.).—A rather slender, erect, smooth perennial 4 to 7 dm. high, with flat leaves and narrow panicles 15 to 25 cm. long. Spikelets pendulous and racemose along the panicle branches.—Shaded canyons, mountains of Colorado, New Mexico, Arizona and prairies of Missouri, Kansas, and western Texas. [Northern Mexico.] July–September.

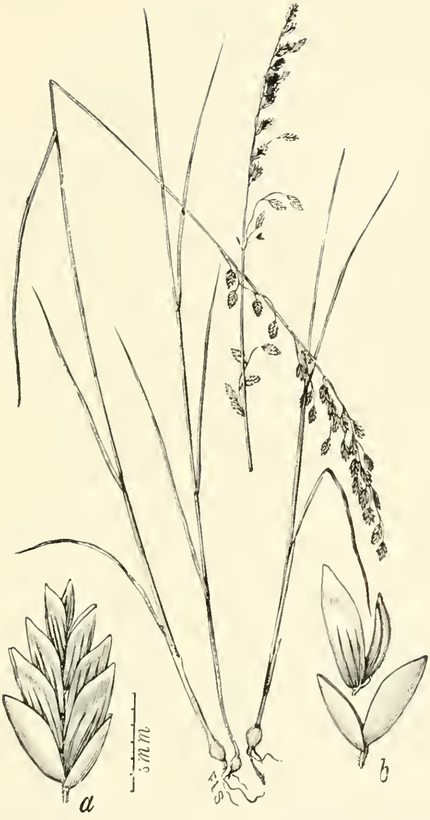


FIG. 259. **Melica spectabilis** Scribn.; Beal, Grasses N. Am., **2**: 506.—A cæspitose, stoloniferous species 3 to 6 dm. high, with scabrous, flat leaves, and loosely flowered, nodding, simple panicles 10 to 20 cm. long.—Damp grassy meadows, rich bottom lands, dry hillsides, etc. (alt. 950 to 2,400 m.), Montana to Washington and Oregon, south to Colorado, Wyoming, and Nevada. June–September.

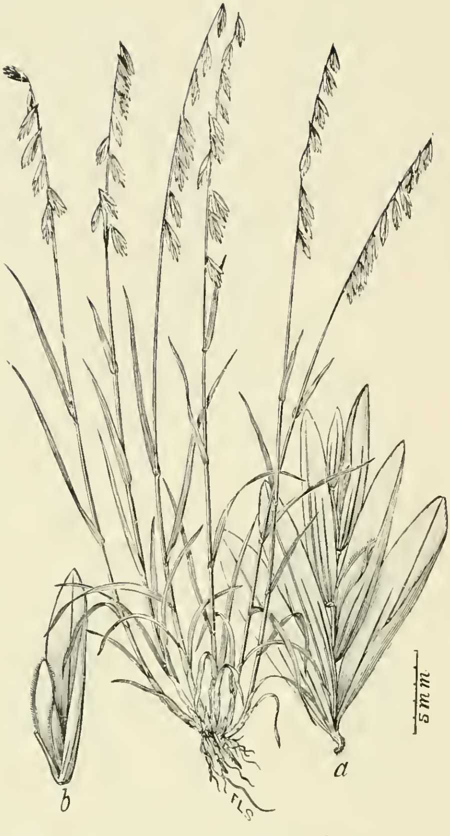


FIG. 260. **Melica stricta** Boland. Beal, Grasses N. Am., **2**: 503. LARGE-FLOWERED MELICA.—A densely cæspitose perennial 2 to 5 dm. high from a bulbous base, with flat, more or less pubescent leaves, and simple, one-sided panicles 10 to 15 cm. long, bearing ten to twenty spikelets.—Dry ridges among rocks (alt. 1,850 to 2,700 m.), Nevada, California, and Oregon. June–August.

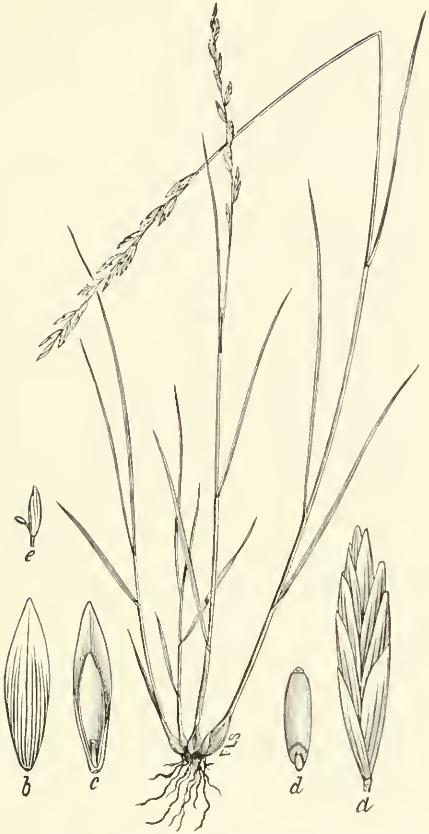


FIG. 261. **Melica bulbosa** Geyer; Beal, Grasses N. Am. **2** : 508. THICK-ROOTED BUNCH-GRASS.—A slender, erect perennial 3 to 6 or rarely 9 dm. high, bulbous at the base, with erect leaves and a narrow, somewhat spike-like panicle 10 to 15 cm. long.—Dry rocky slopes, moist shady mountain sides, etc. (alt. 900 to 2,700 m.), Montana and Wyoming to British Columbia, south to Utah, Nevada, and Oregon; western Texas. May–July.

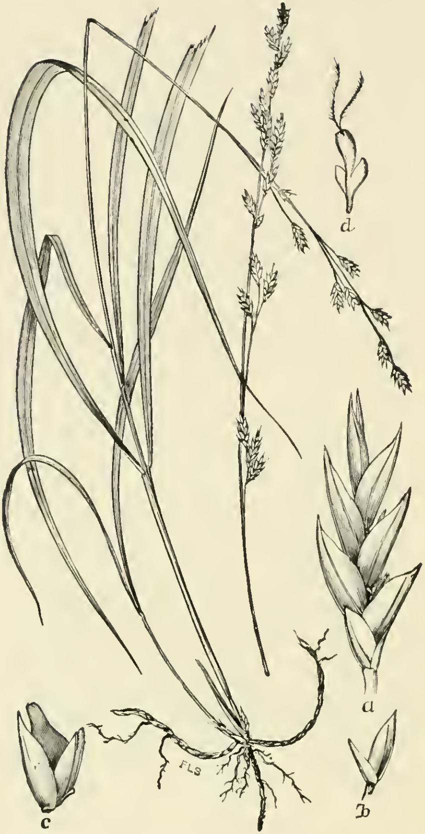


FIG. 262. **Korycarpus diandrus** (Michx.) Kuntze; Britton and Brown, Ill. Fl., **1**: 196; (*Diarrhena americana* Beauv.).—An erect perennial 6 to 9 dm. high, with long, narrow-lanceolate, nearly erect leaves and a few-flowered, simple panicle 10 to 25 cm. long.—Rich, rocky, wooded hillsides, Ohio to South Dakota, south to Georgia, Arkansas, and Indian Territory. August, September.

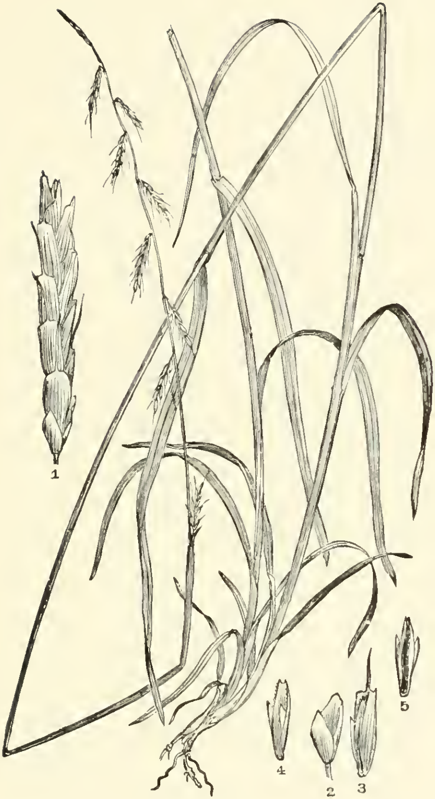


FIG. 263. **Pleuropogon refractum** (A. Gray) Benth. (*Lophochlæna refracta* A. Gray); Beal, Grasses N. Am., **2**: 514. NODDING PLEUROPOGON.—A slender perennial 6 to 12 dm. high from creeping rootstocks, with flat leaves and terminal racemes of six to ten drooping spikelets 2 to 3 cm. long.—In swamps and along mountain streams (alt. 1,200 to 3,850 m.), California to Washington. May–August.

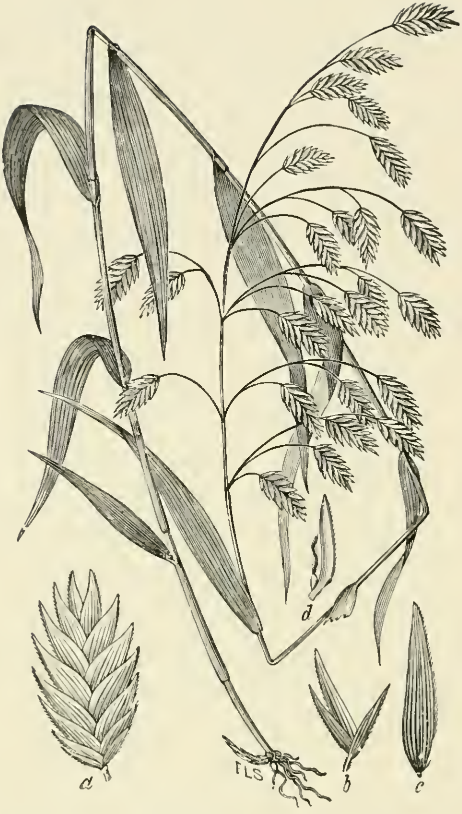


FIG. 264. **Uniola latifolia** Michx. BROAD-LEAFED SPIKE-GRASS.—An erect grass, with rather stout, simple culms 6 to 12 dm. high, broad, spreading leaf blades and a drooping panicle of large, flat spikelets 2 to 3 cm. long.—Low thickets and shaded banks of streams, Pennsylvania to Florida, west to Illinois, Kansas, and Texas. June–October.

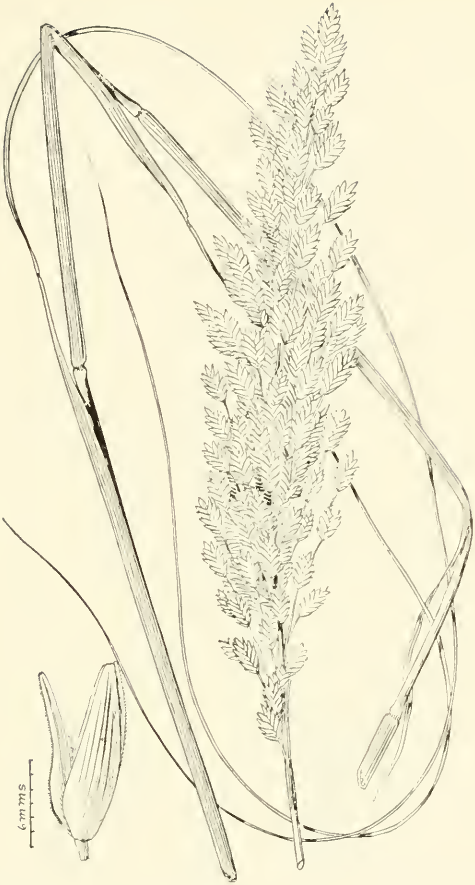


FIG. 265. **Uniola paniculata** L.: Beal, Grasses N. Am., **2**: 516. SEASIDE OATS.—A stout, native perennial 9 to 15 dm. high, with long, rigid leaves and showy, nodding panicles of many broad and pale straw-colored spikelets.—Drifting sand of sea beaches, Virginia to Texas. [West Indies and South America.] May–October.

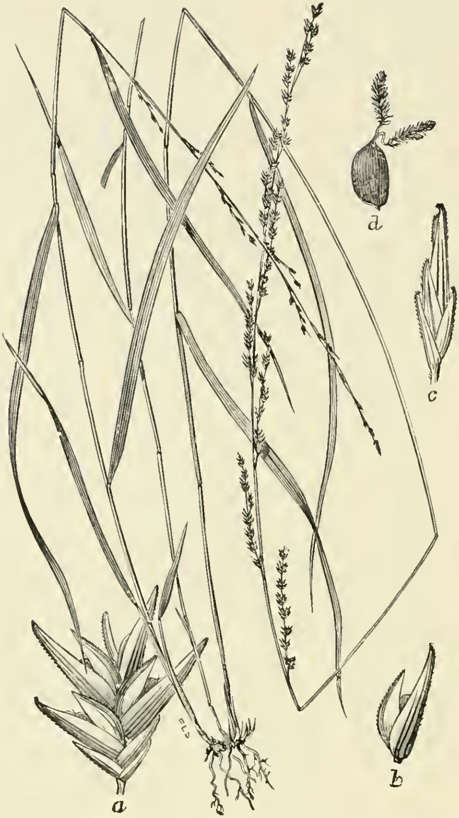


FIG. 266. **Uniola laxa** (L.) B. S. P.; Britton and Brown, Ill. Fl., **1**: 197 (*U. gracilis* Michx.).—A slender grass 6 to 9 dm. high, with long, narrow leaf-blades, and a contracted, wand-like, nodding panicle 15 to 45 cm. long.—In dry soil, open woods, and banks, Long Island to Florida, west to Kentucky, Tennessee, and Texas. June-October.

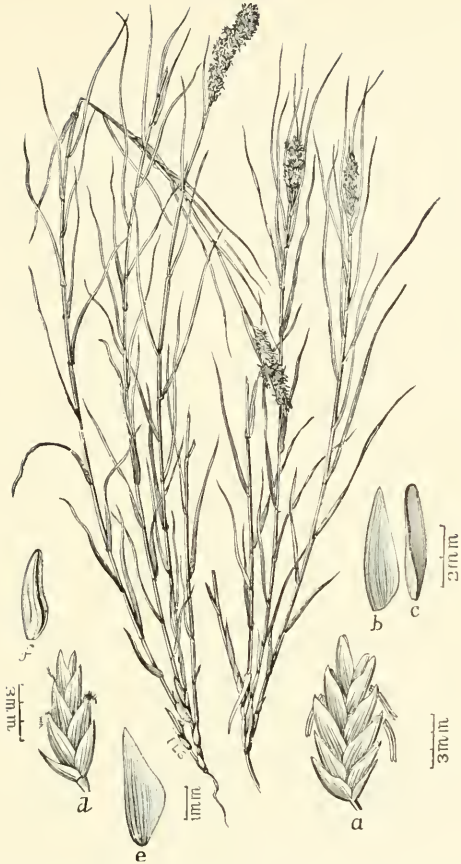


FIG. 267. **Distichlis spicata** (L.) Greene; Britton and Brown, Ill. Fl., **1** : 198 (*D. maritima* Raf.). ALKALI-GRASS.—An upright, wiry grass, 2.5 to 5 dm. high, with strong and widely creeping rootstocks, rather rigid leaves, and densely flowered panicles. The grass is diœcious.—Salt marshes along the coast, Maine to Texas and British Columbia to California; alkaline soil in the interior, Nebraska and Kansas to Montana, eastern Washington, California, and New Mexico. May-August.

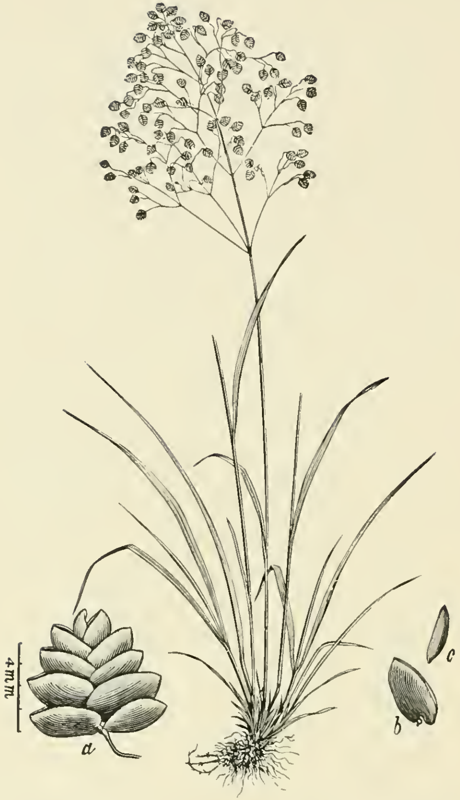


FIG. 268. **Briza media** L. QUAKING-GRASS.—A slender, erect perennial, with rather short, flat leaf-blades and capillary, spreading panicles.—Sparingly naturalized in fields and waste ground, in Ontario, New England, and California. [Europe and Asia.] May–July.

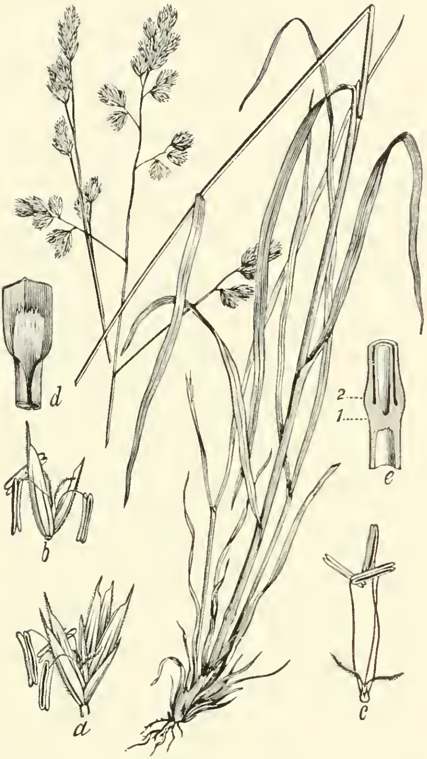


FIG. 269. **Dactylis glomerata** L. ORCHARD-GRASS.—A coarse, erect grass 9 to 12 dm. high, forming dense tufts, with long, flat leaf blades, and spikelets crowded in dense, one-sided clusters at the ends of the panicle branches.—Extensively naturalized in fields and waste ground, New Brunswick to South Carolina, west to Manitoba, Idaho, and Colorado. [Europe.] May–August.

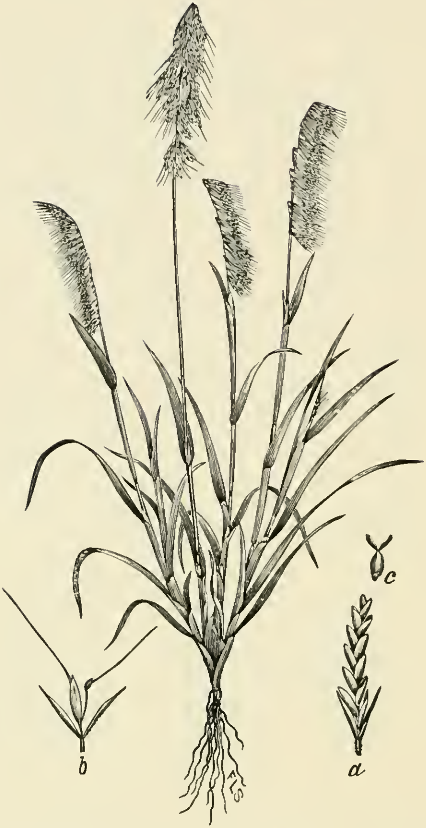


FIG. 270. **Lamarckia aurea** (L.) Moench. GOLDEN-TOP.—A cæspitose, branching annual 1 to 3 dm. high, with elegant one-sided panicles 5 to 8 cm. long.—Introduced into southern and Lower California. [Southern Europe, northern Africa, and Australia.] March-May.

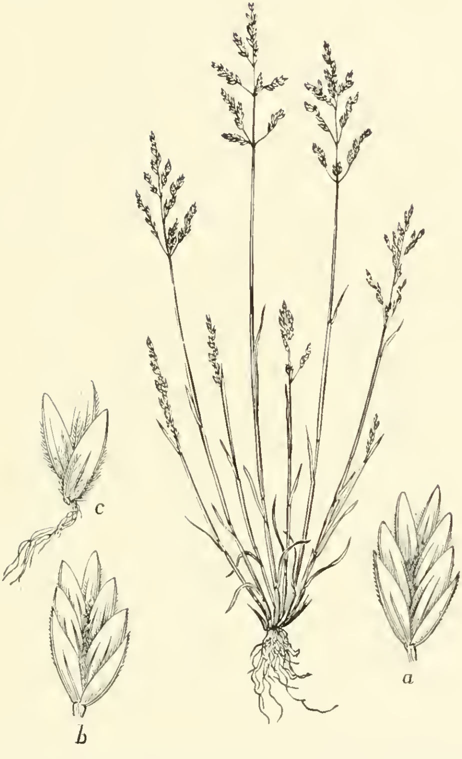


Fig. 271. **Poa chapmaniana** Scribn.—A low, cæspitose annual 1 to 2 dm. high, with ascending, flat leaves and usually narrow panicles 2 to 8 cm. long. Allied to *P. annua*, but more strict in habit of growth.—Dry sandy soil, southern Illinois to Mississippi and Georgia. April, May.

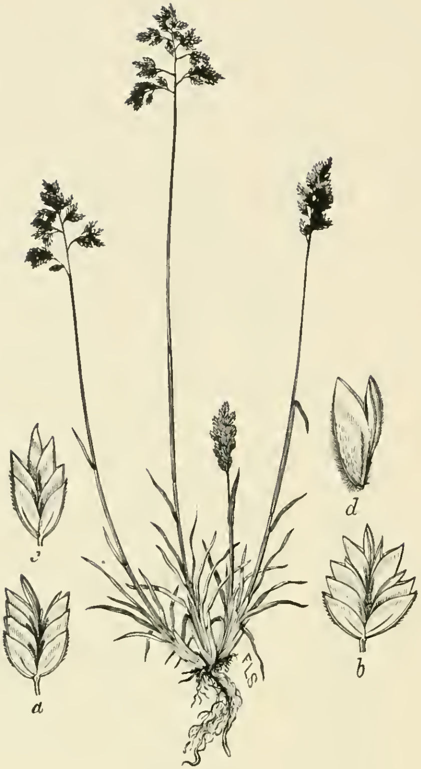


FIG. 272. **Poa alpina** L. MOUNTAIN SPEAR-GRASS.—A slender or stout, cæspitose, erect perennial 0.5 to 3 (usually 1.5) dm. high, with rather broad, flat leaves, and spreading pyramidal panicles of comparatively large spikelets.—Edges of brooks, open grassy mountain slopes, canyons, etc., Newfoundland and Quebec to Hudson Bay and Alaska, south in the mountains to Colorado (alt. 3,600 m.), Utah and California. [Widely distributed, arctic and subalpine.] June–August.

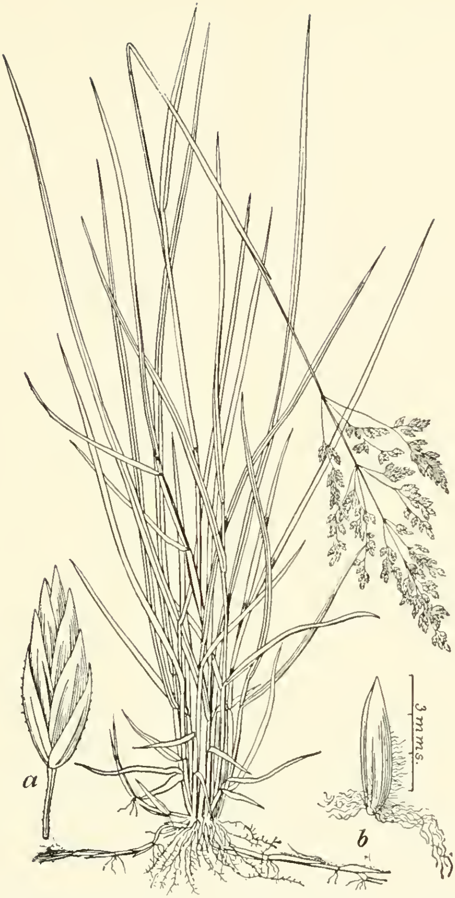


FIG. 273. **Poa pratensis L.** KENTUCKY BLUE-GRASS.—A slender, erect, stoloniferous perennial 3 to 9 dm. high, with narrow, flat leaves and more or less spreading, usually pyramidal panicles.—Fields and meadows throughout the United States and British America, abundantly naturalized in the East, indigenous in the North and West. [Europe and Asia.] Summer. A valuable pasture grass.

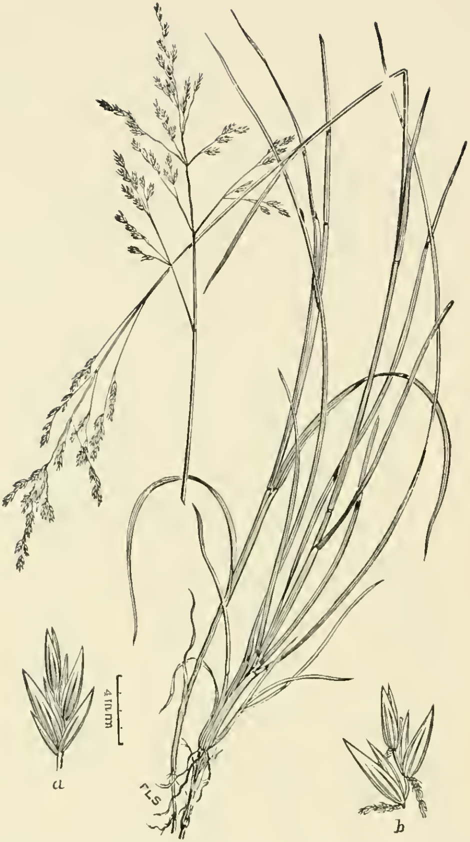


FIG. 274. **Poa kelloggii** Vasey; Ill. N. Am. Grasses, **2**: 79. KELLOGG'S SPEAR-GRASS.—A slender, erect or ascending perennial 4 to 6 dm. high, with rather long, flat leaves and open pyramidal panicles 7 to 10 cm. long. Spikelets two- to four-flowered.—California (4705 Bolander).

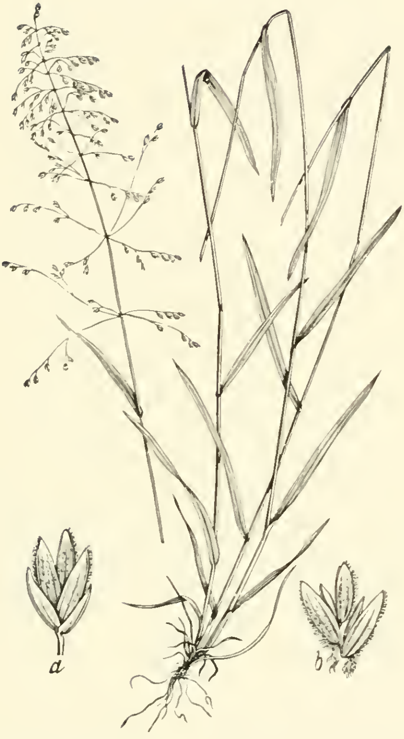


FIG. 275. **Poa sylvestris** A. Gray. WOODLAND SPEAR-GRASS.—A slender, tufted perennial 3 to 9 dm. high, with an open panicle 10 to 15 cm. long, the branches spreading or reflexed.—Rich woods and thickets, New York to Wisconsin and Nebraska, south to North Carolina, Louisiana and Texas. April-July.

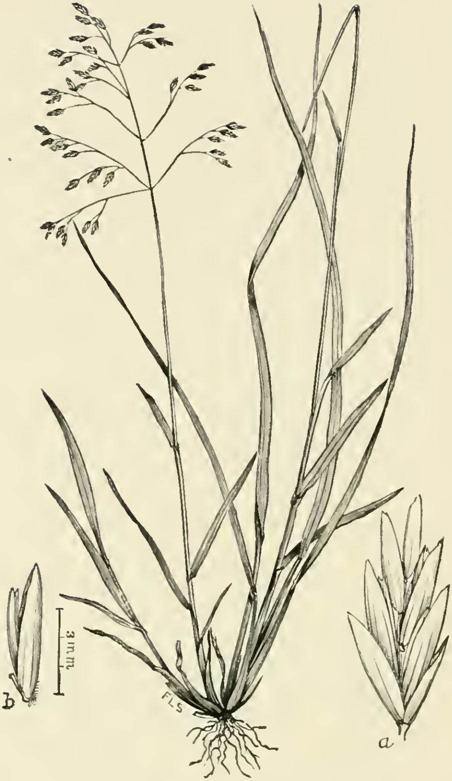


FIG. 276. **Poa brevifolia** Muhl. SOUTHERN SPEAR-GRASS.—An erect perennial 3 to 6 dm. high, with running rootstocks, short culm leaves, and a widely spreading, few-flowered panicle.—Wooded river bluffs and the grassy summits and wooded slopes of mountains, New Jersey to northern Ohio and Illinois, south to North Carolina and Tennessee. March–May.

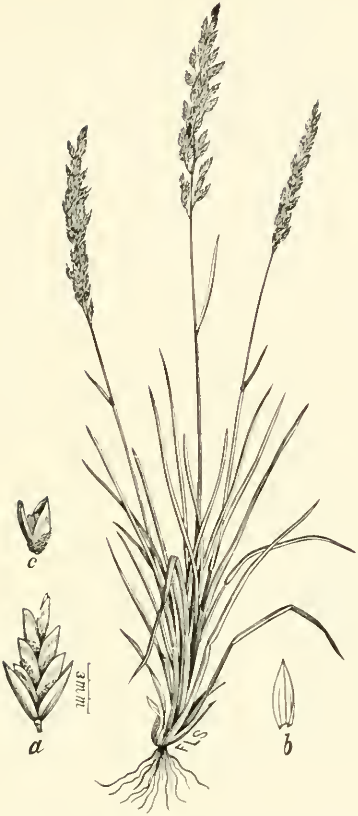


FIG. 277. **Poa arida** Vasey; Britton and Brown, Ill. Fl., **1**: 208. PRAIRIE SPEAR-GRASS.—An erect, often rather rigid, stoloniferous perennial 3 to 6 dm. high, with flat or folded, stiff leaves and narrow, rather densely flowered panicles 8 to 15 cm. long.—Meadows and low grounds, Northwest Territory to Kansas and Arizona. April-August.

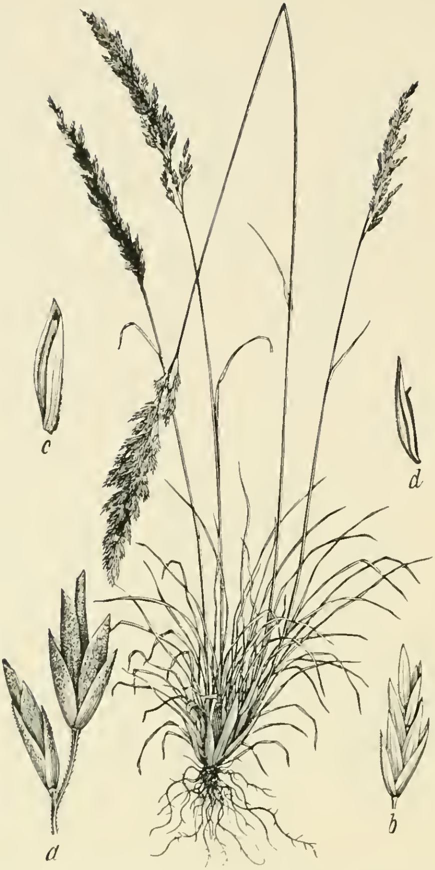


Fig. 278. **Poa buckleyana** Nash; Britton and Brown, Ill. Fl., **1**: 208 (*Poa tenuifolia* Buckley). Bunch Red-top.—A rather slender, erect perennial "bunch grass" 3 to 6 dm. high, with numerous, soft radical leaves and a narrow panicle.—Usually in dry soil of "bench" lands, mountain slopes, elevated prairies, etc. (alt. 450 to 3,900 m.), South Dakota to British Columbia, Colorado, and California. May–September.

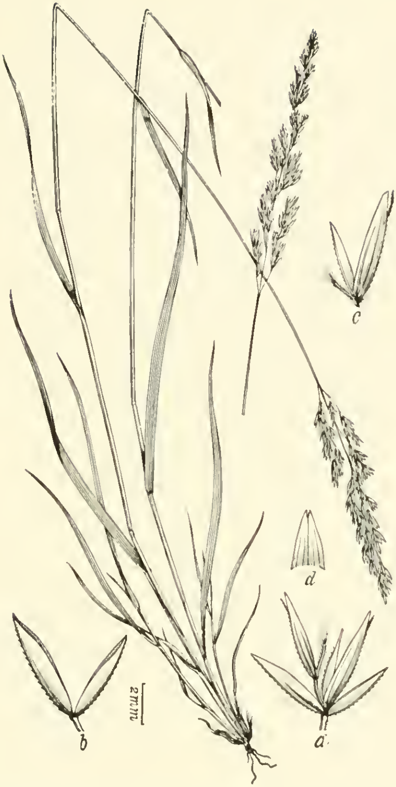


Fig. 279. **Graphephorum melicoideum** (Michx.) Beauv.—A rather slender, erect, pale-green, cæspitose perennial 3 to 6 dm. high, with flat leaves and loosely flowered, nodding panicles 7 to 14 cm. long.—Rocky or gravelly river shores, low woods (sometimes pine woods), etc., Anticosti Island to Vermont, Michigan, and Northwest Territory. August, September. (Allied to Trisetum.)

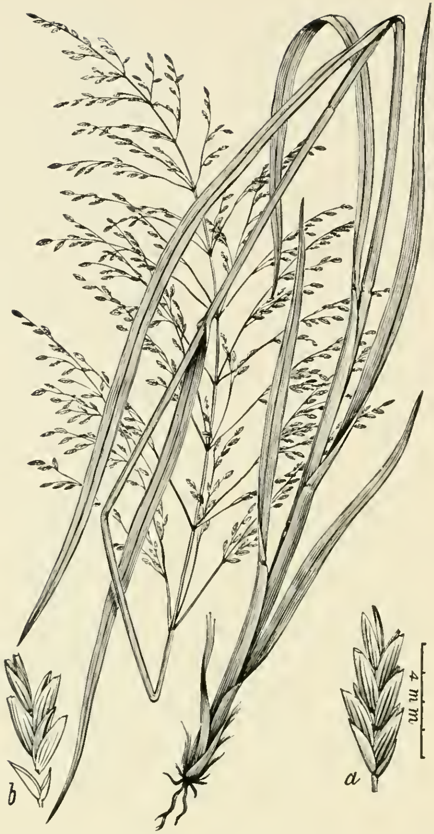


FIG. 280. **Panicularia aquatica** (Sm.) Kuntze (*Glyceria aquatica* J. E. Smith). REED MEADOW-GRASS.—A stout perennial 9 to 15 dm. high, with rather broad, flat leaf blades and an ample open panicle.—Shaded banks of streams, wet meadows, moist thickets, etc., New Brunswick to Alaska, south to Pennsylvania, Tennessee, Nebraska, New Mexico, and southern California. June–August.

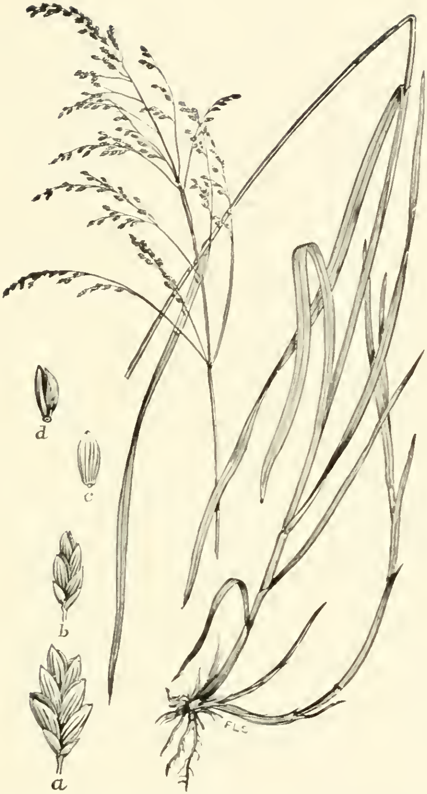


Fig. 281. **Panicularia nervata** (Willd.) Kuntze (*Glyceria nervata* Trin.). Fowl Meadow-grass.—A leafy perennial 3 to 9 dm. high, with an expanded, nodding panicle, and rather small spikelets.—Wet meadows, marshes, moist thickets, etc., Newfoundland to Florida, west to British Columbia, California, and Arizona. June-September.

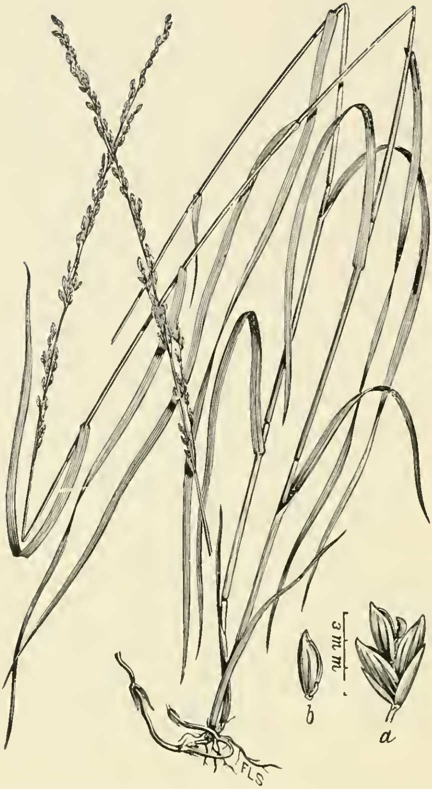


FIG. 282. **Panicularia elongata** (Torr.) Kuntze (*Glyceria elongata* Trin.) (*Poa elongata* Torr.).—An erect perennial 6 to 9 dm. high, with flat leaf blades and narrow, rather densely flowered panicles.—In rich, wet woods, Newfoundland and New Brunswick to North Carolina, west to Quebec, Minnesota, and Kentucky. July–September.

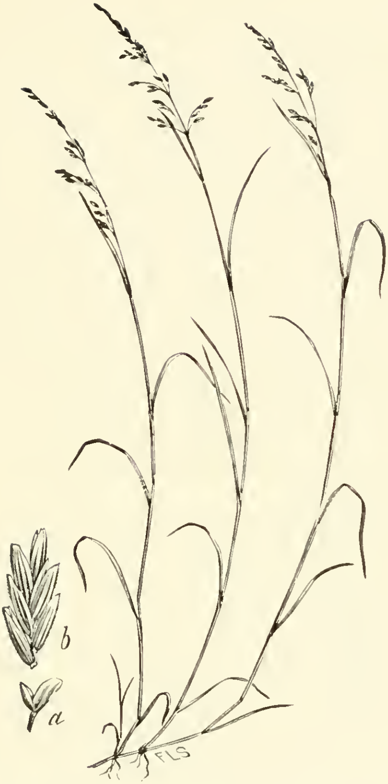


Fig. 283. **Panicularia pallida** (Torr.) Kuntze (*Glyceria pallida* Trin. *Windsoria pallida* Torr.). Pale Manna-grass.—A perennial, with slender stems 3 to 9 dm. long, ascending from a more or less decumbent base, and a lax, few-flowered panicle with ascending branches.—Bogs, banks of streams and ponds, Cape Breton to Ontario, south to Virginia, eastern Tennessee and Indiana. June–August.

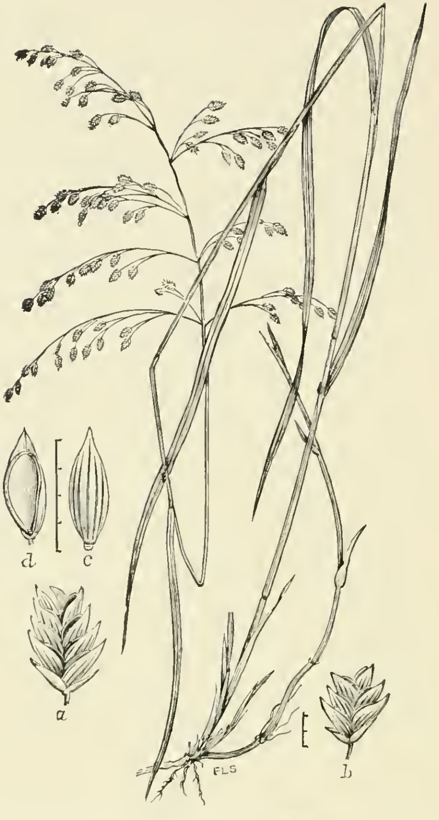


FIG. 284. **Panicularia canadensis** (Michx.) Kuntze; Britton and Brown, Ill. Fl., **1**: 211 (*Glyceria canadensis* Trin.). RATTLESNAKE-GRASS.—A stout, native perennial 6 to 9 dm. high, with flat leaves, and ample, nodding panicles of rather large spikelets.—Marshes and ditches. Newfoundland and Nova Scotia to Minnesota, south to New Jersey, Ohio, and Kansas. June–August.

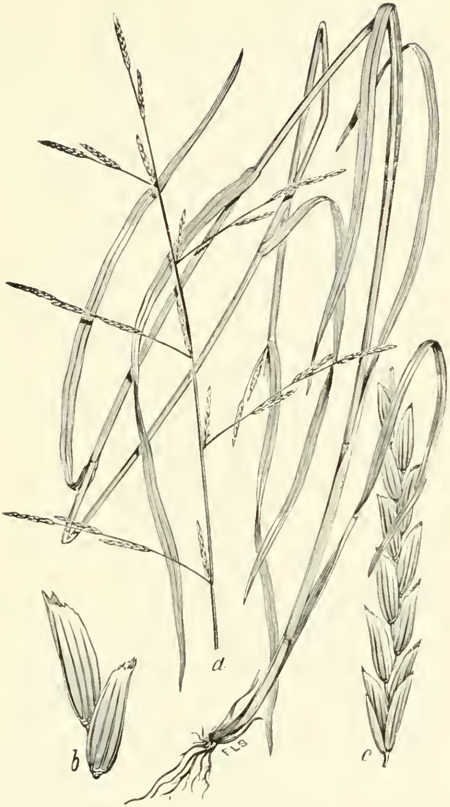


Fig. 285. **Panicularia fluitans** (L.) Kuntze (*Glyceria fluitans* R. Br.). Floating Manna-grass.—An erect grass 9 to 15 dm. high with somewhat flattened culms, long leaves, and a narrow panicle about 3 dm. long.—Wet places, often in running water, Newfoundland to Alaska, south to North Carolina, Tennessee, Texas, and California. [Widely distributed in temperate regions.] May–September.

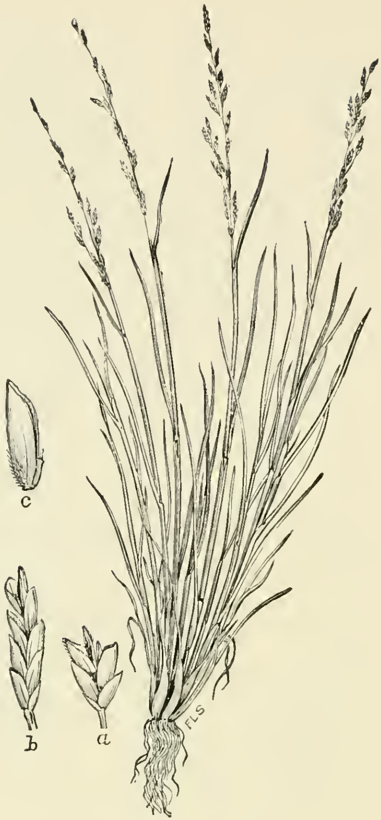


FIG. 286. **Puccinellia maritima** (Huds.) Parl. (*Poa maritima* Huds.; *Glyceria maritima* M. & K.). SEA SPEAR-GRASS.—A slender perennial 2 to 5 dm. high, from creeping rootstocks, with narrow, flat, or folded leaves, and more or less expanded panicles 8 to 12 cm. long.—Salt marshes and beaches along the coast, Labrador to southern New England, and Alaska to British Columbia; also on ballast and waste ground in sea ports farther south. [Europe and Asia.] July, August.

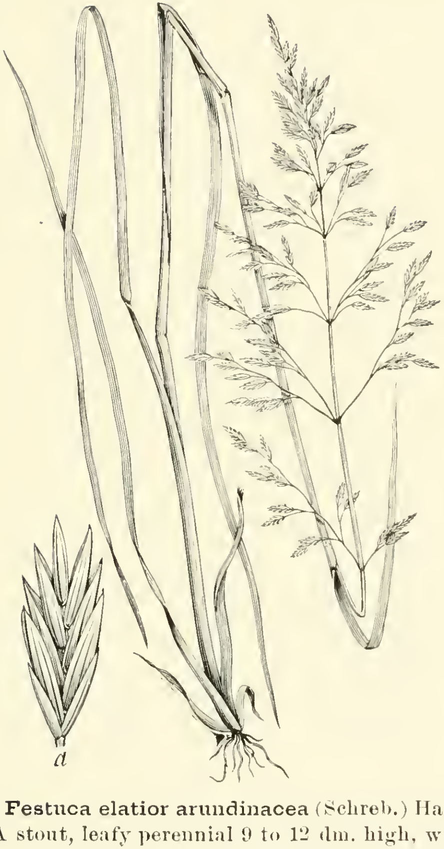


FIG. 287. **Festuca elatior arundinacea** (Schreb.) Hack. REED FESCUE.—A stout, leafy perennial 9 to 12 dm. high, with broad, flat leaves, and ample, elongated panicles often 3 dm. long.—Introduced here and there, District of Columbia, Michigan, Utah, Oregon, etc. [Europe.] August.

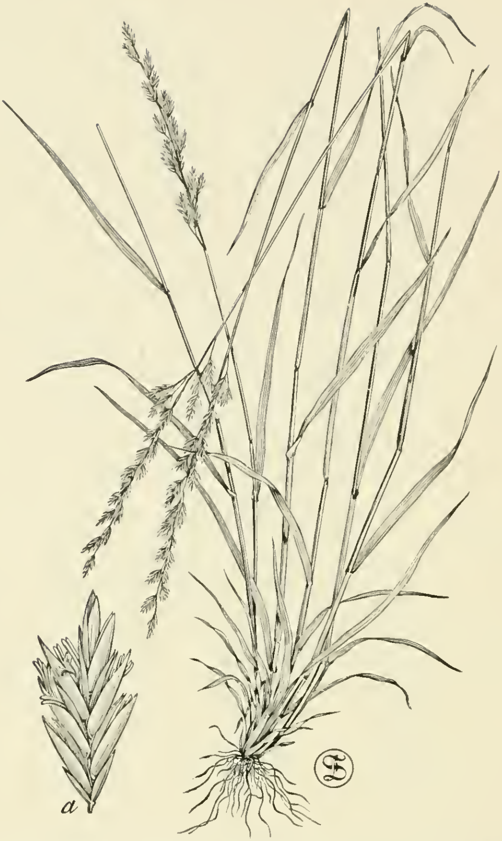


FIG. 288. **Festuca elatior pratensis** (Huds.) Hack. MEADOW FESCUE.—An upright perennial 6 to 9 dm. high, with numerous flat leaves and a rather narrow panicle 10 to 20 cm. long.—In fields and waysides, introduced, Nova Scotia to North Carolina, west to Washington, Oregon, and Kansas. June–August.

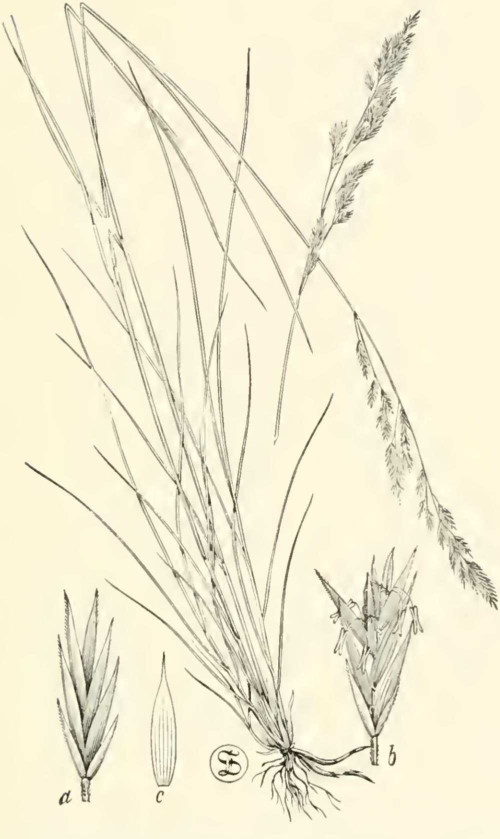


FIG. 289. **Festuca rubra glaucescens** Hack.; Beal, Grasses N. Am., **2** : 606. TENNESSEE FESCUE.—A slender perennial 3 to 6 dm. high, with creeping rootstocks, erect or ascending stems, very narrow, usually glaucous leaves, and lax, nodding panicles. Forms a dense turf.—Bluffs of Cumberland River, Nashville, Tenn. May.

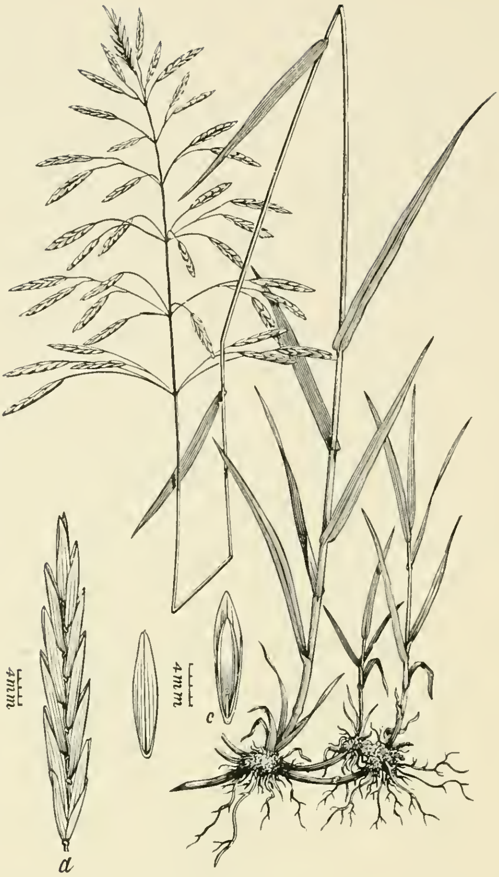


Fig. 290. **Bromus inermis** Leyss. Smooth Brome or Hungarian Brome-grass.—An erect perennial 6 to 15 dm. high, with creeping rootstocks, open panicles 12 to 18 cm. long, and five- to nine-flowered, awnless spikelets 2 to 3 cm. long.—A native of Europe, introduced and cultivated in many parts of the United States for hay. June, July.

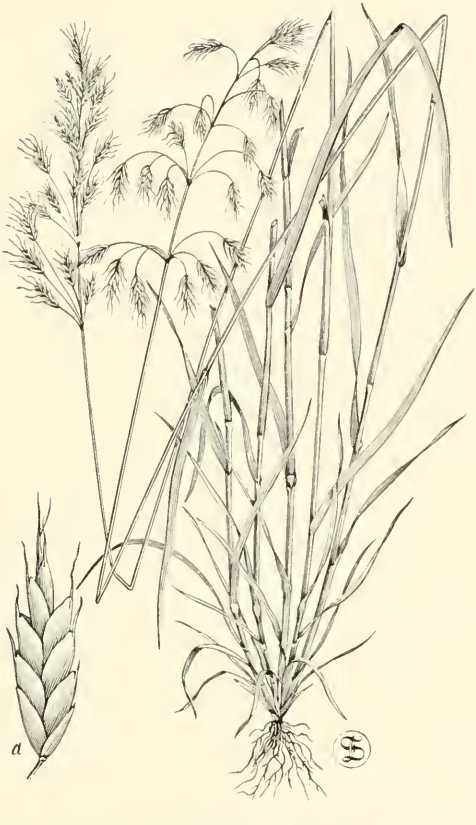


FIG. 291. **Bromus secalinus** L. CHESS OR CHEAT.—An erect annual 6 to 9 dm. high, with flat leaves, more or less expanded panicles, and turgid, short-awned spikelets, which are pendulous in fruit.—Naturalized in cultivated and waste grounds, especially in grain fields. [Europe and Asia.] June-August.

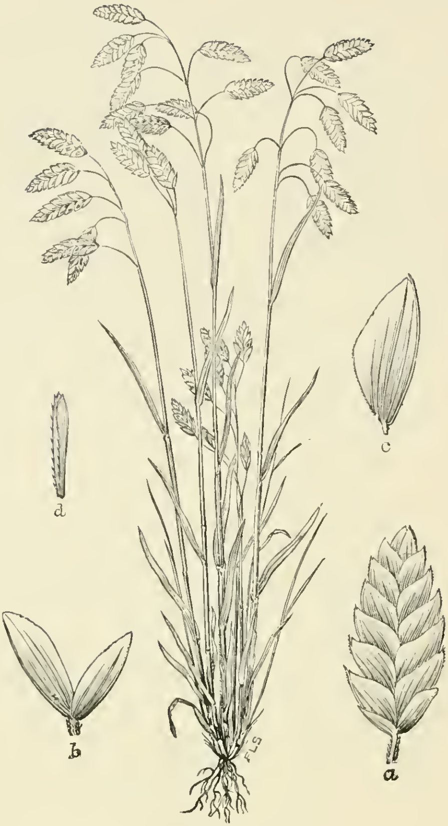


FIG. 292. **Bromus brizaeformis** Fisch. & Mey. BRIZA-LIKE BROME-GRASS.—A slender, erect, cæspitose annual 2 to 5 dm. high, with soft, flat leaves and nodding panicles of large ten- to fifteen-flowered spikelets 2 to 3 cm. long.—Meadows and cultivated fields, introduced, Montana to Washington, south to Utah, Nevada, and California; sparingly in Massachusetts, New York, and Pennsylvania. [Europe and Asia.] June–August.

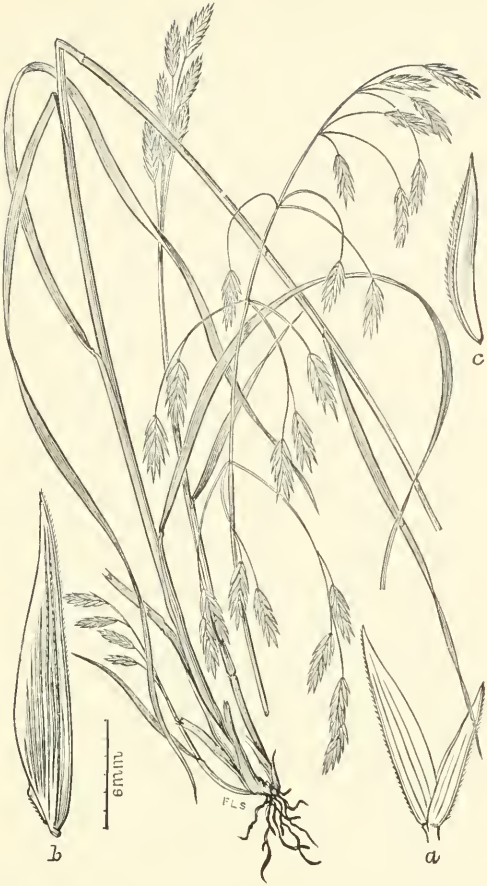


Fig. 293. **Bromus unioloides** (Willd.) HBK. Rescue-grass.—An erect, usually annual grass, 3 to 9 dm. high, with more or less pubescent, flat leaf blades, and usually nodding, loose panicles of rather large, strongly flattened spikelets.—Prairies and dry, sandy fields, Indian Territory and Texas to Arizona; naturalized in Alabama. [Mexico and South America.] March–July.

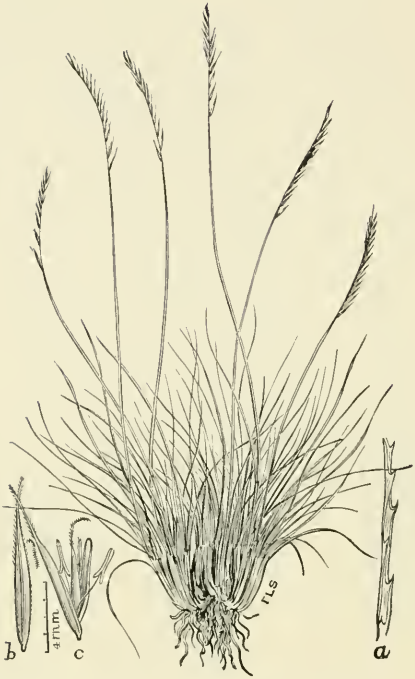


Fig. 294. **Nardus stricta** L.; Britton and Brown, Ill. Fl., **1**: 224. Wire Bent.—A glabrous, densely cæspitose perennial, with stout, creeping rootstocks, setaceous leaves, and erect, filiform, rigid culms, 10 to 20 cm. high.—Introduced at Amherst, Mass.; rocky river banks, Newfoundland. [Europe, Greenland and Azores.] August.

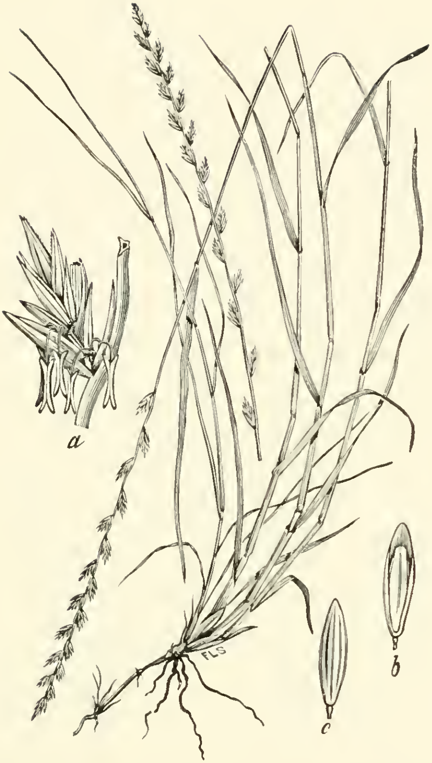


FIG. 295. **Lolium perenne L.** RYE-GRASS.—A smooth, leafy perennial 3 to 9 dm. high, with slender, terminal spikes 7.5 to 25 cm. long.—Lawns, fields, and waysides, naturalized, Canada to North Carolina, west to Ohio and Tennessee; California and Arizona. [Europe and Asia.] May-August.

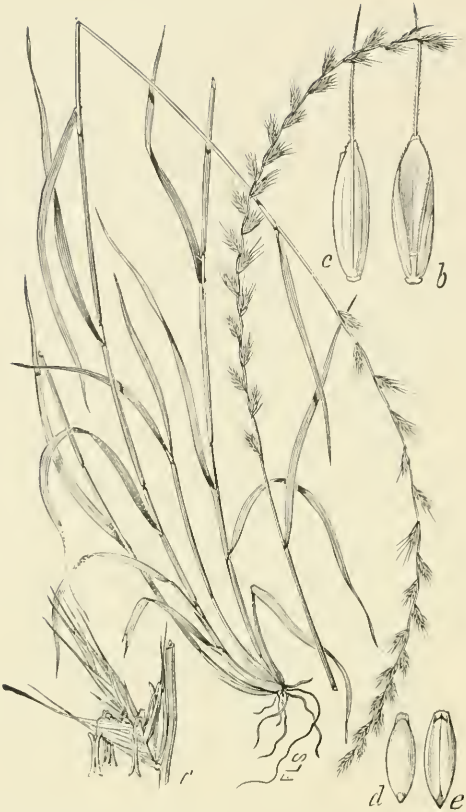


FIG. 296. **Lolium italicum** A. Br. ITALIAN RYE-GRASS.—A biennial or perennial grass 6 to 9 dm. high, with slender, usually somewhat nodding, terminal spikes, and short-awned spikelets. A valuable hay grass.—Introduced here and there through cultivation, especially on the Pacific Slope.

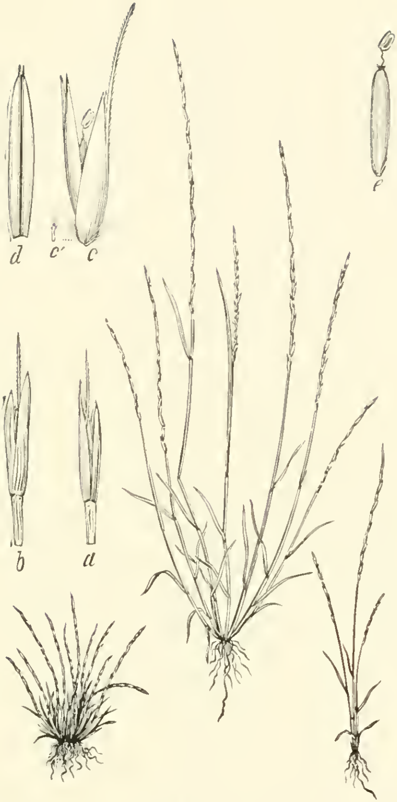


Fig. 297. **Scribneria bolanderi** (Thurb.) Hack. (*Lepturus bolanderi* Thurb.). Beal, Grasses N. Am., **2** : 634.—A slender, wiry, cæspitose annual 1 to 2 dm. high, with short, narrow leaves and terminal, slightly compressed spikes.—Sterile grounds, hillsides, and roadsides, Washington to California. May.

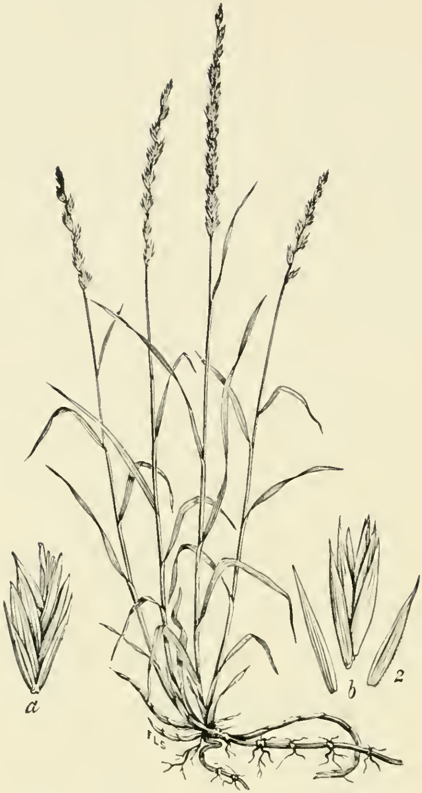


FIG. 298. **Agropyron repens** (L.) Beauv. (*Triticum repens* L.). COUCH-GRASS.—An erect, stoloniferous perennial 3 to 12 dm. high, with flat leaves, which are pilose along the nerves above, and terminal, densely flowered spikes.—Naturalized in lawns, waysides, and cultivated ground, Newfoundland and Cape Breton to Northwest Territory, south to District of Columbia, Ohio, and Iowa. [Europe and Asia.] June–September.

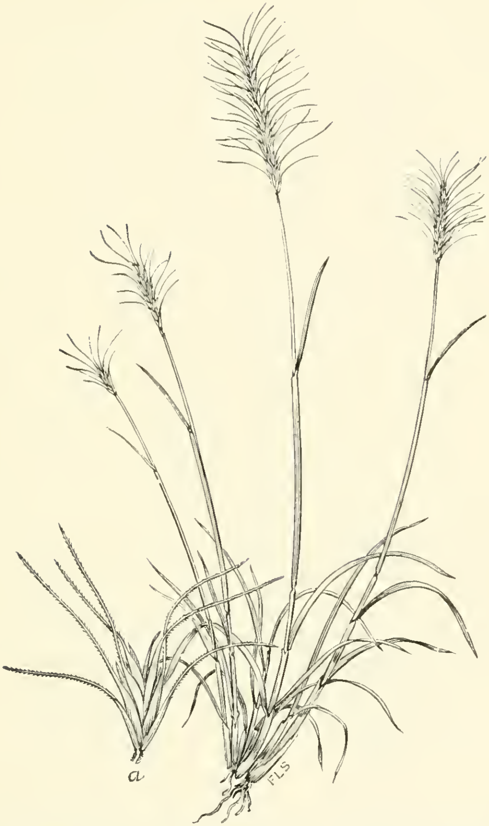


Fig. 299. **Agropyron scribneri** Vasey; Beal, Grasses N. Am., **2**: 638.—A densely cæspitose perennial 2 to 5 dm. high, with ascending culms, flat leaves, and bearded spikes 5 to 7 cm. long, which readily break up at maturity.—Summits of mountains (alt. 1,800 to 4,200 m.), Montana to Colorado and Arizona. August.

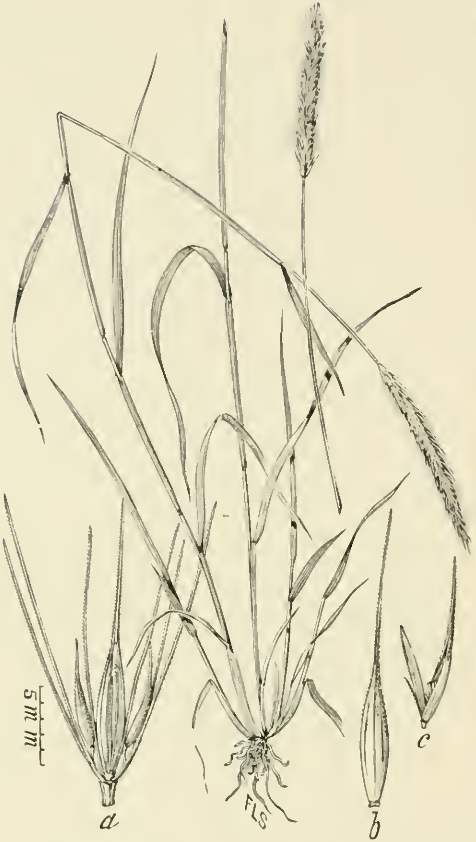


FIG. 300. **Hordeum boreale** Scribn. & Smith, Bull. 4, Div. Agrost., 28 (1897). NORTHERN WILD BARLEY.—A slender, erect and apparently perennial grass 3 to 6 dm. high, with rather broad, flat leaves, smooth culms and terminal spikes 7 to 10 cm. long.—Mountains of California to Alaska and Bering Sea islands. June, July.

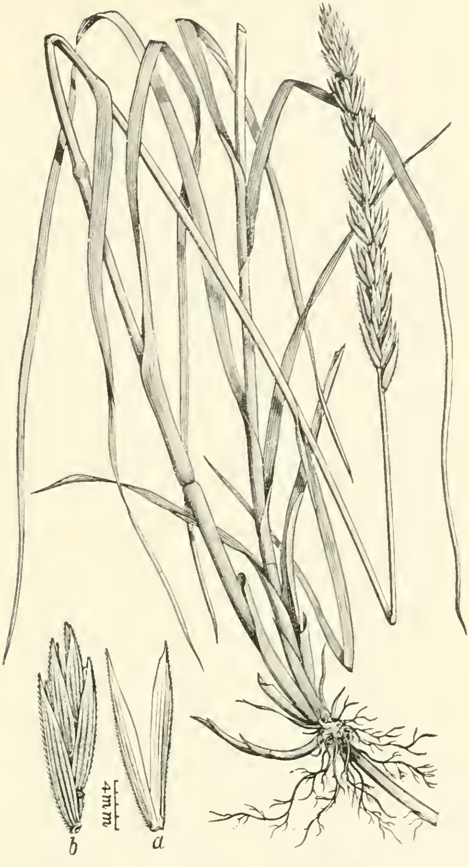


FIG. 301. **Elymus arenarius** L. SEA LYME-GRASS.—A stout, erect perennial 6 to 12 dm. high, with extensively creeping rootstocks, rather firm, flat, sharp-pointed leaves and terminal, usually densely flowered spikes 8 to 25 cm. long. Glumes usually villous.—In maritime sands, Greenland and Labrador to Maine; Alaska to California and on the shores of the Great Lakes. [Europe and Asia.] July, August.

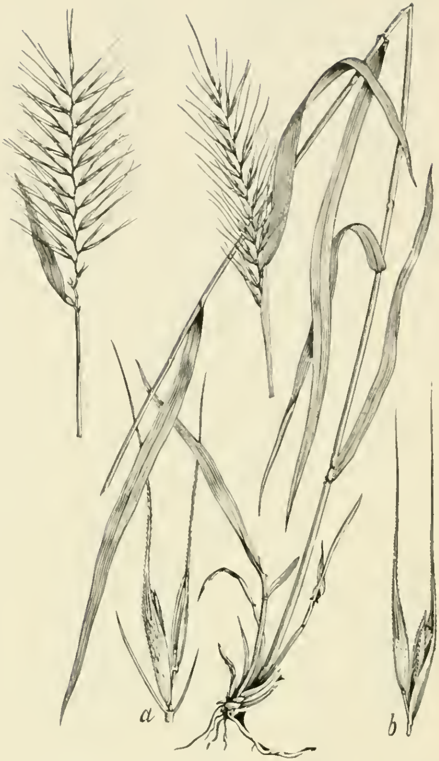


FIG. 302. **Asperella hystrix** (L.) Moench (*Asprella* W. not Schreb.; *Hystrix patula* Moench; *Gymnostichum hystrix* Schreb.). BOTTLE BRUSH.—A smooth, cæspitose perennial 6 to 12 dm. high, with rather broad, flat leaves and terminal spikes 6 to 12 cm. long. Spikelets widely spreading at maturity.—Fertile, rocky woods, New Brunswick and Ontario to Georgia, Alabama, Arkansas, and Minnesota. June–August.

INDEX TO THE COMMON NAMES.

Page.
Alkali-grass 285
    Saccatone.......... 74
American Oat....................... 183
Banner Sorghum.................... 34
Barley 14
Barnyard-grass 82
Beach-grass........................ 167
Bearded-joint 77
    Short-husk 130
Beard-grass......................... 150
Bermuda-grass..................... 189
Big Blue-stem...................... 32
Bitter Panic-grass 73
Black Bunch-grass.................. 38
    Grama 37
    Mountain Rice 110
Blue Grama......................... 222
Bottle Brush....................... 320
Branching Foxtail 85
Bristly Mesquite................... 223
Briza-like Brome-grass 310
Broad-leafed Spike-grass........... 282
Brook-grass........................ 27
Broom Sedge........................ 28
Buffalo-grass............... .... 12, 238
Bunch Redtop 296
Burk's Grama 225
California Hair-grass.............. 172
California Timothy................. 99
Canary-grass 10
Carpet-grass 42
Catch-fly-grass.................... 92
Cheat 309
Chess 309
Clustered Salt-grass 230
Common Reed 247
Cotta-grass 241

Page.
Cotton-grass 60
Couch-grass 316
Crab-grass 9, 258
Creek Sedge 195
Creeping Mesquite 36
    Panic 70
    Reimaria.................. 40
Crowfoot-grass..................... 228
Densely-flowered Bent 155
    Plume-grass 21
Dog's-tail-grass 273
Downy Oat-grass.................... 178
Early Bunch-grass.................. 270
    Wild Oat-grass............. 171
Eaton's-grass 269
Elliott's Broom Sedge.............. 30
    Paspalum 41
English Ray-grass 14
Everlasting-grass.................. 53
False Buffalo-grass 245
Feather-grass 237
Few-flowered Sorghum 35
Fine-top Salt-grass 145
Flat-stemmed Panic 71
    Sporobolus......... 143
Floating Foxtail 133
    Manna-grass 303
Florida Amphicarpon................ 51
    Paspalum 48
Fowl Meadow-grass 239
Fox-grass.......................... 192
Freshwater Cord-grass.............. 191
Galleta 8, 39
Gama-grass 19
Gibbous Panic-grass 65
Golden Top 288
Goose-grass 227

Page.
Green Foxtail 83
Hairy Grama 220
Havard's Grama 216
Herd's grass 11
Hungarian Brome-grass 308
Hungarian-grass 86
Indian Corn 7
Indian-grass 33
Millet 115
Reed 152
Italian Millet 86
Ray-grass 14
Rye-grass 314
Jamaica Crab-grass 61
Jungle Rice 81
Kellogg's Spear-grass 292
Kentucky Blue-grass 13, 291
Knot-grass 43
Large-flowered Melica 278
Large-leafed Vanilla-grass 102
Large Water-grass 49
Lemmon's Wool-grass 54
Little Blue-stem 31
Crab-grass 56
Lizard-tail grass 24
Long-awned Poverty-grass 106
Long-leafed Sporobolus 139
Long-spiked Bur-grass 88
Long-stalked Panic 80
Louisiana-grass 42
Maize 7
Many-flowered Trichloris 208
Many-spiked Chloris 205
Marram grass 167
Marshy Oat-grass 177
Mat-grass 23
Meadow Fescue 306
Foxtail 134
Mexican Dropseed 118
Millet 9
Mission-grass 90
Morton's Oat-grass 184
Mountain Foxtail 135
Hair-grass 176
Spear-grass 290
Naked Beard-grass 209

Page.
Nealley's Leptochloa 234
Nimble Will 117
Nit-grass 159
Nodding Oat-grass 182
Pleuropogon 281
Northern Panic-grass 76
Wild Barley 318
Oat-like Hair-grass 175
Oats 12
One-flowered Grama 212
Orchard-grass 13, 287
Pale Manna-grass 301
Phippsia 136
Porcupine-grass 107
Prairie-grass 137
Spear-grass 295
Purple Canary-grass 97
Purple grass 239
Pursh's Amphicarpon 50
Quaking-grass 286
Rattlesnake-grass 302
Redfield's grass 256
Reed Fescue 305
Meadow-grass 298
Rescue-grass 311
Rice 9
Rice Cut-grass 94
Rocky Mountain Oat-grass 179
Rothrock's Grama 221
Rough Foxtail 84
Leptochloa 233
Round-flowered Panic 75
Rush-like Spartina 194
Timothy 131
Rye 14
Rye-grass 313
Salt Cedar 244
Reed-grass 190
Sand Bur 87
Sea Lyme-grass 319
Sea Spear-grass 304
Seaside Finger-grass 200
Oats 283
Short-awned Grama 219
Reed-grass 161
Short-haired Reed-grass 168

Page.

- Short-leafed Beard-grass 210
- Short-stalked Eragrostis 260
  - Meadow-grass 265
- Side Oats 213
- Silky Oat-grass 188
- Silver Beard 29
  - Panic-grass 58
- Silvery Beard-grass 29
  - Hair-grass 170
  - Oat-grass 181
- Six-weeks Mesquite 214
- Slender Cut-grass 96
- Slender-flowered Dropseed 119
- Slender Hair-grass 174
  - Oat-grass 180
  - Panicum 57
  - Paspalum 44
- Slough grass 226
- Small-flowered Mountain Rice 114
- Small Grama 224
- Small-jointed Panic-grass 64
- Smooth Brome 308
  - Chloris 198
  - Crab-grass 55
  - Paspalum 45
- Smut-grass 144
- Soft Wool-grass 52
- Southern Canary-grass 98
  - Spear-grass 259, 294
  - Water-grass 59
- Spider Bent grass 158
- Sprouting Crab-grass 69
- Strong-scented Sporobolus 139
- Sugar Cane 7
- Swamp Poverty-grass 104
- Sweet Vernal-grass 10, 100
- Switch-grass 72
- Tall Grama 213

Page.

- Tall Oat-grass 185
- Tennessee Fescue 307
  - Oat-grass 187
- Texan Crab-grass 211
  - Grama 215
- Texas Blue-grass 13
  - Millet 62
- Thatch 195
- Thick-rooted Bunch-grass 279
- Thread-like Muhlenbergia 126
- Timothy 11, 132
- Toothache-grass 196
- Torrey's Silver Beard-grass 26
- Tufted Hair-grass 173
- Vanilla-grass 10, 101
- Velvet-grass 169
- Vine Mesquite-grass 63
- Viscid Leptochloa 231
- Warty Panic-grass 67
- Water Whorl-grass 274
- Western Cord-grass 193
- Wheat 14
- White-grass 95
- White Mountain Rice 111
- Wild Millet 116
  - Mountain Rice 113
  - Oat-grass 186
  - Timothy 121
- Windmill-grass 203
- Wire Bent 312
- Wire-grass 103
- Wiry Grama 218
- Woodland Dropseed 120
  - Spear-grass 293
- Woolly-jointed Grama 217
  - Poverty-grass 105
- Wrinkly-flowered Paspalum 46
- Yard-grass 227

INDEX TO THE LATIN NAMES.

[Tribes in SMALL CAPITALS and synonyms in *italics.*]

Page.

- *Ægilops aromatica*, 196
- Ægopogon, 8
- Agropyron, 14
  - repens, 316
  - scribneri, 317
- AGROSTIDEÆ, 10, 12
- Agrostis, 10, 11
  - *arachnoides*, 158
  - *asper*, 137
  - coarctata, 154
  - *compressa*, 143
  - densiflora, 155
  - diegoënsis, 157
  - elliottiana, 158
  - *foliosa*, 157
  - humilis, 153
  - varians, 153
- Aira, 12
  - caryophyllea, 170
  - *danthonioides*, 175
  - *nitida*, 271
  - præcox, 171
  - subspicata, 178
- Alopecurus, 10, 11
  - geniculatus, 133
  - occidentalis, 135
  - pratensis, 134
- Ammophila, 11
  - arenaria, 167
  - *arundinacea*, 167
- Amphicarpon, 9
  - floridanum, 51
  - purshii, 50
- Andropogon, 7
  - argyræus, 29
  - elliottii, 30

Page.

- Andropogon *furcatus*, 32
  - glomeratus, 27
  - *macrourus*, 27
  - nutans, 33
  - pauciflorus, 35
  - *polydactylon*, 205
  - provincialis, 7, 32
  - saccharoides, 26
  - scoparius, 31
  - *secundus*, 34
  - *torreyanus*, 26
  - unilateralis, 34
  - virginicus, 7, 28
- ANDROPOGONEÆ, 7
- Anthænantia, 9
- Anthoxanthum, 10
  - odoratum, 100
- Apera, 11
- Arctagrostis, 11
- Aristida, 11
  - gossypina, 105
  - *lanata*, 105
  - palustris, 104
  - stricta, 103
  - tuberculosa, 106
- Arrhenatherum, 12
  - elatius, 185
- Arundinaria, 15
- Arundo, 13
  - *brevipilis*, 168
  - *phragmites*, 247
  - *vulgaris*, 247
- Asperella, 14
  - hystrix, 320
- *Asprella hystrix*, 320
- Avena, 12

Page.
Avena americana 183
  elatior 185
  hookeri 183
  mortoniana 184
  sativa 12
  spicata 186
AVENEÆ 11, 12
BAMBUSEÆ 14
Beckmannia 12
  erucæformis 226
Blepharidachne 13
Bouteloua 12
  aristidoides 214
  breviseta 219
  burkii 225
  curtipendula 213
  eriopoda 217
  havardi 216
  hirsuta 223
  oligostachya 222
  racemosa 213
  ramosa 218
  rothrockii 221
  texana 215
  trifida 224
  uniflora 212
  vestita 220
Brachyelytrum 11
  aristatum 130
  erectum 130
Briza 13
  media 286
Bromus 13
  brizæformis 310
  inermis 308
  secalinus 309
  spicatus 229
  unioloides 311
Buchloë 12
  dactyloides 238
Bulbilis 12
  dactyloides 238
Calamagrostis aleutica 163
  bolanderi 165
  breviseta 161
  crassiglumis 160

Page.
Calamagrostis deschampsioides 162
  howellii 166
  pickeringii 161
  tweedyi 164
Calamovilfa 11
  brevipilis 168
Campulosus 12
  aromaticus 196
  chapadensis 197
Capriola 12
  dactylon 189
Catabrosa 13
  aquatica 274
Cathestecum 13
  erectum 242
  prostratum 242
Cenchrus 9
  granularis 24
  myosuroides 88
  tribuloides 87
Chætochloa 9, 86
  composita 85
  corrugata 84
  glauca 83
  viridis 83
CHLORIDEÆ 12
Chloris 12
  alba 204
  cucullata 202
  dubia 235
  elegans 204
  floridana 199, 201
  glauca 198
  neglecta 199, 201
  petræa 200
  polydactylon 205
  swartziana 200, 201
  texensis 206
  verticillata 203
Cinna 10, 11
  arundinacea 152
  macroura 148
Coleanthus 6, 11
Colpodium 13
Corynephorus 12
Cottea 13

Page.

- Cottea pappophoroides 241
- *Crypsis schœnoides* 131
- *Ctenium* 12
    - *americanum* 196
    - *chapadense* 197
- *Cynodon* 12
    - *dactylon* 189
- Cynosurus 13
    - *ægyptius* 228
    - cristatus 273
- Dactylis 13
    - glomerata 13, 286
    - *maritima* 195
    - *patens* 192
- Dactyloctenium 12
    - *ægyptiacum* 228
    - ægyptium 228
- Danthonia 12
    - compressa 187
    - sericea 188
    - spicata 186
- Deschampsia 12
    - atropurpurea 176
    - calycina 175
    - elongata 174
    - flexuosa 173
    - holciformis 172
- *Diarrhena* 13
    - *americana* 280
- *Digitaria serotina* 56
- *Diplachne dubia* 235
    - *imbricata* 232
    - *reverchoni* 229
    - *rigida* 268
    - *spicata* 229
    - *viscida* 231
- Dissanthelium 13
    - californicum 257
- Distichlis 13
    - *maritima* 285
    - spicata 285
- Dupontia 13
- Eatonia 13
    - *dudleyi* 271
    - filiformis 272
    - nitida 271

Page.

- Eatonia obtusata 270
    - pennsylvanica 269
- Eleusine 6, 12
    - indica 227
- Elionurus 7
    - barbiculmis 25
- Elymus 14
    - arenarius 319
- Epicampes 11
    - ligulata 149
    - rigens 148
- Eragrostis 13
    - abyssinica 258
    - brownii 262
    - ciliaris 266
    - *conferta* 264
    - curtipedicellata 260
    - frankii 265
    - glomerata 264
    - hypnoides 263
    - neo-mexicana 258
    - pectinacea 260, 261
    - plumosa 267
    - purshii 259
    - *reptans* 263
    - sessilispica 268
- *Eremochloë* 13
- Erianthus 7
    - compactus 21
    - strictus 22
- Eriochloa 9
    - lemmoni 54
    - mollis 52
    - punctata 53
- Eriocoma cuspidata 115
- Euchlæna 7
- *Eustachys floridana* 201
    - *glauca* 198
- Festuca 13
    - elatior arundinacea 305
    - elatior pratensis 306
    - rubra glaucescens 307
- FESTUCEÆ 11, 13
- Gastridium 11
    - *australe* 159
    - lendigerum 159

Page

- *Glyceria* 13
  - *aquatica* 298
  - *canadensis* 302
  - *elongata* 300
  - *fluitans* 303
  - *maritima* 304
  - *nervata* 299
  - *pallida* 301
- Gramineæ 5
- Graphephorum 13
  - *flexuosum* 256
  - melicoideum 297
- *Greenia arkansana* 151
- Gymnopogon 12
  - ambiguus 209
  - brevifolius 210
  - *racemosus* 209
- *Gymnostichum hystrix* 320
- Gynerium 13
- Hackelochloa 7
  - granularis 24
- Heleochloa 11
  - schœnoides 131
- *Hemarthria fasciculata* 23
- *Hierochloë* 10
  - *borealis* 101
  - *macrophylla* 102
- Hilaria 8
  - cenchroides 36
  - jamesii 38
  - mutica 37
  - rigida 39
- Holcus 10, 12
  - lanatus 169
- Homalocenchrus 9
  - hexandrus 93
  - lenticularis 92
  - monandrus 96
  - oryzoides 94
  - virginicus 95
- HORDEÆ 14
- Hordeum 14
  - boreale 318
- Hydrochloa 9
- *Hystrix patula* 320
- Imperata 7

Page.

- Imperata *brevifolia* 20
  - *caudata* 20
  - hookeri 20
- *Ischæmum secundatum* 90
- Kœleria 13
- Korycarpus 13
  - diandrus 280
- Lagurus 11
- Lamarckia 13
  - aurea 288
- *Leersia* 9
  - *hexandra* 93
  - *lenticularis* 92
  - *monandra* 96
  - *oryzoides* 94
  - *virginica* 95
- Leptochloa 12
  - dubia 235
  - fascicularis 230
  - imbricata 232
  - *langloisii* 233
  - mucronata 237
  - nealleyi 234
  - pringlei 236
  - scabra 233
  - spicata 229
  - *stricta* 234
  - viscida 231
- Lepturus 14
  - *bolanderi* 315
- *Lesourdia karwinskyana* 243
  - *multiflora* 243
- Limnodia 11
  - arkansana 151
- Lolium 14
  - italicum 314
  - perenne 313
- *Lophochlæna refracta* 281
- Luziola 9
  - alabamensis 91
- Lycurus 11
- Manisuris 7
  - compressa 23
  - *granularis* 24
- MAYDEÆ 6
- Melica 13

Page.

- Melica bulbosa 279
  - *glabra* 275
  - mutica 275
  - parviflora 276
  - *porteri* 276
  - spectabilis 277
  - stricta 278
- Milium 11
  - effusum 116
  - *lendigerum* 159
- Miscanthus 7
- Molinia 13
- Monanthochloë 13
  - littoralis 244
- Muhlenbergia 11
  - diffusa 117
  - filiculmis 126
  - *glomerata* 121
  - gracilis 129
  - gracillima 124
  - mexicana 118
  - porteri 123
  - pringlei 122
  - pungens 125
  - racemosa 121
  - schaffneri 127
  - sylvatica 120
  - tenuiflora 119
  - *texana* 123
  - virescens 128
  - *willdenovii* 119
- Munroa 13
  - squarrosa 245
- Nardus 14
  - stricta 312
- Nazia 8
- Oplismenus 9
- Orcuttia 13
  - californica 246
- Oryza sativa 9
- ORYZEÆ 9
- Oryzopsis 11
  - asperifolia 111
  - exigua 113
  - fimbriata 112
  - *kingii* 108

Page.

- Oryzopsis melanocarpa 110
  - *membranacea* 115
  - micrantha 114
  - mongolica 109
- PANICACEÆ 6
- PANICEÆ 8
- Panicularia 13
  - aquatica 298
  - canadensis 302
  - elongata 300
  - fluitans 303
  - nervata 299
  - pallida 301
- Panicum 9
  - amarum 73
  - anceps 71
  - barbulatum 77
  - boreale 76
  - bulbosum 74
  - colonum 81
  - columbianum 78
  - *corrugatum* 84
  - crus-galli 82
  - *dactylon* 189
  - demissum 79
  - filipes 68
  - gibbum 65
  - *glabrum* 55
  - gracillimum 57
  - grossarium 61
  - *hians* 66
  - lanatum 60
  - *leucophæum* 60
  - lineare 55
  - longipedunculatum 80
  - melicarium 66
  - *molle* 52
  - nashianum 79
  - obtusum 63
  - paspaloides 59
  - phæothrix 58
  - proliferum 69
  - repens 70
  - sanguinale 189
  - serotinum 56
  - sphærocarpon 75

Page.

- Panicum stenodes 64
  - texanum 62
  - verrucosum 67
  - virgatum 72
  - *viride* 83
- Pappophorum 13
  - apertum 240
  - *boreale* 239
  - wrightii 239
- Paspalum 9, 12
  - compressum 42
  - difforme 47
  - *digitaria* 41
  - dilatatum 49
  - distichum 43
  - *elliottii* 41
  - floridanum 48
  - læve 45
  - *ovatum* 49
  - paspaloides 41
  - *platycaule* 42
  - plicatulum 46
  - setaceum 44
- Pennisetum 9
  - setosum 89
- Pereilema 11
- PHALARIDEÆ 10
- Phalaris 10
  - amethystina 97
  - angusta 99
  - caroliniana 98
  - *erucæformis* 226
  - *intermedia* 98
- Pharus 9
- Phippsia 11
  - algida 136
- Phleum 11
  - pratense 132
  - *schœnoides* 131
- Phragmites 13
  - *communis* 247
  - vulgaris 247
- Pleuropogon 13
  - refractum 281
- *Pleuraphis rigida* 39
- Poa 13

Page.

- Poa alpina 290
  - *ambigua* 250
  - arida 295
  - brevifolia 294
  - buckleyana 296
  - chapmaniana 289
  - *ciliaris* 266
  - *conferta* 264
  - *elongata* 300
  - *glomerata* 264
  - *hypnoides* 263
  - kelloggii 292
  - *maritima* 304
  - pratensis 291
  - sylvestris 293
  - *tenuifolia* 296
- POACEÆ 9
- Polypogon 11
  - monspeliensis 150
- Puccinellia 13
  - maritima 304
- Redfieldia 13
  - flexuosa 256
- Reimaria 9
  - oligostachya 40
- *Rottbœllia* 7
  - *compressa* 23
- Saccharum 7
- Savastana 10
  - macrophylla 102
  - odorata 101
- Schedonnardus 12
  - paniculatus 211
  - *texanus* 211
- Scleropogon 13
  - brevifolius 243
- Scolochloa 13
- Scribneria 14
  - bolanderi 315
- Secale 14
- *Setaria* 9
  - *composita* 85
  - *corrugata* 84
  - *italica* 86
  - *viridis* 83
- Sieglingia 13

Page.

Sieglingia acuminata 253
  albescens 251
  americana 255
  eragrostoides 248
  nealleyi 252
  pulchella 254
Sorghum pauciflorum 35
Spartina 10, 12
  cynosuroides 191
  densiflora 194
  glabra 195
  gouini 194
  gracilis 193
  juncea 192
  junciformis 194
  patens 192
  polystachya 190
  stricta maritima 195
Sporobolus 6, 11
  airoides 145
  argutus 146
  asper 137
  compressus 143
  confusus 147
  curtisii 142
  floridanus 141
  heterolepis 139
  indicus 144
  interruptus 140
  longifolius 138
Stenochloa californica 257
Stenotaphrum 9
  americanum 90
  secundatum 90
Stipa 11
  kingii 108
  membranacea 115
  mongolica 109
  spartea 107
Syntherisma linearis 55
  serotina 56
Thurberia 11
  arkansana 151
Trachynotia polystachya 190

Page.

Trachypogon 7
Tragus 8
Trichloris 12
  blanchardiana 207
  fasciculata 207
  pluriflora 208
Tricuspis monstrosa 243
Triodia 13
  acuminata 253
  albescens 251
  ambigua 250
  eragrostoides 248
  nealleyi 252
  pulchella 254
  texana 249
Triplasis americana 255
Tripsacum 7
  dactyloides 19
Trisetum 12
  canescens 181
  cernuum 182
  elongatum 180
  interruptum 180
  montanum 179
  palustre 177
  subspicatum 178
TRISTEGINEÆ 8
Triticum 14
  repens 316
Uniola 13
  gracilis 284
  latifolia 282
  laxa 284
  paniculata 283
Vilfa arguta 146
  rigens 148
Weingærtneria 12
Windsoria pallida 301
Zea 7
Zizania 9
Zizaniopsis 9
Zoysia 8
ZOYSIEÆ 8

For 3rd ed., see
630.81
Ag912

LIBRARY
NEW YORK
BOTANICAL
GARDEN.

BULLETIN NO. 7, REVISED EDITION.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

AMERICAN GRASSES—I.

(ILLUSTRATED.)

BY

F. LAMSON-SCRIBNER,
AGROSTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

Bulletin No. 7, Revised Edition.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

AMERICAN GRASSES—I.

(ILLUSTRATED.)

BY

F. LAMSON-SCRIBNER,
AGROSTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Agrostology,
Washington, D. C., April 22, 1898.

Sir: I submit herewith copy for a new and revised edition of Bulletin No. 7 of this division and recommend its publication. This bulletin contains 302 illustrations of native and introduced grasses, accompanied by brief descriptions and notes upon the distribution of each. The law governing the publications of this Department limited the first edition of Bulletin No. 7 to 1,000 copies, which was quickly exhausted; and as applications for it are continually being received, a new edition is necessary to meet this demand. There are also some slight revisions and corrections necessary to bring the work up to date. Manuscript for a similar bulletin illustrating over 300 additional species is now ready for the press, and when published can be bound with No. 7, which may be treated as Part I of "American Grasses Illustrated." Notes upon the use and value of the species of economic interest were published in Bulletin No. 3 of this division, "Useful and Ornamental Grasses."

The drawings are all from carefully selected specimens, the habit sketches being made by Mr. A. H. Baldwin. The enlarged details were drawn by myself, with the exception of a few which were made by Miss M. D. Baker. The engraving is the work of Mr. L. S. Williams and Mr. George P. Bartle. The work has all been done in the office of the division, with the exception of that performed by Mr. Bartle.

Respectfully, F. Lamson-Scribner,
Agrostologist.

Hon. James Wilson,
Secretary of Agriculture.

INTRODUCTION.

In order to make the present publication more useful to students of grasses, the order Gramineæ and the several tribes into which the order has been divided by our best authorities are here briefly characterized. Under the tribes the genera which are native or have been introduced are enumerated, and those having species figured in this bulletin are marked with an asterisk (*).

GRAMINEÆ—GRASSES.

Characters of the order.—Fibrous-rooted, annual or perennial, herbaceous (rarely woody) plants, with usually hollow, cylindrical (rarely flattened) and jointed stems (*culms*) whose internodes for more or less of their length are enveloped by the sheath-like basal portion of the two-ranked and usually linear, parallel-veined leaves; flowers without any distinct perianth, hermaphrodite or rarely unisexual, solitary or several together, in *spikelets*, which are arranged in panicles, racemes, or spikes, and which consist of a shortened axis (the *rachilla*) and two or more chaff-like, distichous imbricated bracts (*glumes*), of which the first two, rarely one or none or more than two, are empty (*empty glumes*); in the axil of each of the succeeding bracts (excepting sometimes the uppermost) is borne a flower (hence these are named *flowering glumes*). Opposed to each flowering glume, with its back turned toward the rachilla, is (usually) a two-nerved, two-keeled bract or prophyllum (the *palea*), which frequently envelops the flower by its infolded edges. At the base of the flower, between it and its glume, are usually two very small hyaline scales (*lodicules*);

rarely there is a third lodicule between the flower and the palea; stamens, usually three (rarely two or one, or more than three) with very slender filaments and two-celled, usually versatile anthers; pistil with a one-celled, one-ovuled ovary, and one to three, usually two, styles with variously branched, most frequently plumose, stigmas; embryo small, lying at the front and base of the seed, covered only by the thin pericarp; fruit a caryopsis, rich in albumen. (In *Sporobolus* and *Eleusine* the thin pericarp is free from the seed.)

Number of species.—There are about thirty-five hundred known species of grasses, varying in size from the moss-like *Coleanthus* of the North to the tree-like bamboos of the Tropics, which tower to the height of 30 m. or more; and ranging in distribution from Kerguelen Land on the South to the extreme limit of vegetation beyond the Arctic Circle. There is no order of plants more widely distributed, or existing under a greater diversity of soil and climate, and no other order presents such a vast number of individual plants or is so important and directly useful to man.

SERIES A.—PANICACEÆ.

Spikelets one- rarely two-flowered; when two-flowered the second or terminal one is perfect, the first or lower one being either staminate or neuter; rachilla articulated below the empty glumes, the spikelets falling from the pedicels entire, either singly, in groups, or together with the joints of an articulate rachis. The first six tribes belong to this series.

TRIBE I.—*Maydeæ.*

Spikelets unisexual, the staminate forming a part of the inflorescence with the pistillate, or each in a separate inflorescence on the same plant; flowering glumes hyaline or much less firm in texture than the outer ones; axis of the female spikelets usually articulated.

This is a small tribe, numbering only sixteen species classed in seven genera. They are nearly all natives of the Tropics, chiefly in the Old World. Indian corn, or maize, is our best known example of the Maydeæ.

Euchlæna Schrad.
Zea Linn.
Tripsacum Linn.*

TRIBE II.—*Andropogoneæ.*

Spikelets in spike-like racemes, two at each joint of the articulate rachis, one sessile and hermaphrodite, one pedicellate, the latter hermaphrodite, staminate, neuter, or reduced to the pedicel alone; glumes usually four, the first and second empty, larger and much firmer in texture than the others, the third usually empty, with a staminate flower in its axil, very rarely awned, the fourth or flowering glume hyaline, usually awned, awn usually twisted or geniculate.

This tribe contains about four hundred species divided among twenty-nine genera, of which the genus *Andropogon*, with one hundred and ninety species, is by far the largest and probably the most important. Sugar cane belongs to this tribe in the genus *Saccharum*. Our best known representatives of the Andropogoneæ are the common broom sedge, *Andropogon virginicus*, and the big blue stem, *Andropogon provincialis*. In the same genus are now classed our species of sorghum. The members of the tribe are distributed throughout the tropical and warmer regions of both hemispheres.

Imperata Cyr.*
Miscanthus Anderss.
Saccharum Linn.
Erianthus Michx.*
Manisuris Linn.*
(*Rottboellia* Linn. f.)
Hackelochloa Kuntze.*
(*Manisuris* Sw. not Linn.)
Trachypogon Nees.
Elionurus HBK.*
Andropogon Linn.*

TRIBE III.—*Zoysieæ*.

Spikelets solitary or in groups of two to eight, each group falling as a whole from the continuous rachis, usually one-flowered, hermaphrodite, or staminate and hermaphrodite in the same group; flowering glume less firm in texture than the awned or awnless outer ones, which are herbaceous, chartaceous, or coriaceous; the first glume is usually larger than the second.

A small tribe, numbering about twenty-five species which represent nearly half that number of genera. Fifteen species are natives of the tropical and warmer temperate regions of America. Black grama, or *Galleta*, as the Mexicans name it, species of *Hilaria*, are our best-known representatives of the tribe.

Hilaria Kunth.*
Ægopogon HBK.
Nazia Adans. (*Tragus* Hall).
Zoysia Willd.

TRIBE IV.—*Tristegineæ*.

Spikelets all hermaphrodite, in panicles; empty glumes three, or the third with a staminate flower in its axil, herbaceous or chartaceous; flowering glumes membranaceous, awned or awnless; rachilla articulated below the empty glumes.

A small tribe of only seven genera and thirty-three species, natives chiefly of the tropical regions of the Old World. Of the few American species none extend so far north as the United States.

TRIBE V.—*Paniceæ*.

Spikelets hermaphrodite, terete or flattened on the back; glumes three or four (rarely only two); when four there is occasionally a staminate flower or a palea in the axil of the third; the uppermost or flowering glume of the hermaphrodite flower is always firmer in texture than the outer glumes, of which the first is usually smaller than the others; axis of the inflorescence not articulated, the rachilla being articulated below the empty glumes, the spikelets falling off singly from their pedicels.

This is one of the largest tribes in the order Gramineæ. It contains twenty-two genera with over six hundred and thirty species. *Panicum*, the principal genus, is the largest among grasses, numbering three hundred species. The *Paniceæ* are very widely distributed throughout the tropical and temperate regions of the world. Crab-grass and the millets are among our best known examples of this tribe.

Reimaria Flügge.*
Paspalum Linn.*
Anthænantia Beauv.
Amphicarpon Raf.*
Eriochloa Kunth.*
Panicum Linn.*
Oplismenus Beauv.
Chætochloa Scribn.*
(*Setaria* Auct.)
Cenchrus Linn.*
Pennisetum Pers.*
Stenotaphrum Trin.*

TRIBE VI.—*Oryzeæ*.

Spikelets usually much compressed laterally, one-flowered, staminate, pistillate, or hermaphrodite; empty glumes two or none, the flower being subtended by the floral glume and palea alone, the latter one-nerved and regarded by some as a second glume; stamens frequently six; axis of the inflorescence not articulated.

A small tribe of about forty species divided among sixteen genera, mostly confined to tropical America. One of the best known and most extensively used of the cereals, rice (*Oryza sativa*), belongs here.

Hydrochloa Beauv.
Pharus Linn.
Luziola Juss.*
Zizaniopsis Doell and Asch.
Zizania Linn.
Oryza Linn.
Homalocenchrus Mieg.*
(*Leersia* Sw.)

SERIES B.—POACEÆ.

Spikelets one- to many-flowered, the imperfect or rudimentary flower, if any, usually uppermost; rachilla usually articulated above the empty glumes, so that these remain after the fall of the fruiting glume.[1] In spikelets with two or more flowers these are separated by a manifest internode of the rachilla, and in such cases the rachilla is usually articulated below each flowering glume.

TRIBE VII.—*Phalarideæ.*

Spikelets more or less laterally compressed, one- or rarely three-flowered; glumes five, the first two empty and below the articulation of the rachilla, the third and fourth above the articulation, usually empty, very unlike the outer ones, rarely subtending staminate flowers, sometimes reduced to mere bristles, the fifth glume with a one-nerved or nerveless palea and a hermaphrodite flower.

A small tribe, comprising six genera with about sixty species of comparatively little importance. Several of the species, sweet vernal grass and vanilla grass, are remarkable for possessing a peculiar fragrance due to their containing coumarin. Canary-grass is one of the best known members of this tribe.

Phalaris Linn.*
Anthoxanthum Linn.*

Savastana Schrank.*
(*Hierochloë* Gmelin).

TRIBE VIII.—*Agrostideæ.*

Spikelets all hermaphrodite, one-flowered with three glumes, the first two empty (very rarely wanting), usually as long as or exceeding the third or floral glume; rachilla sometimes prolonged behind the palea into a naked or plumose bristle. Palea two-nerved (one-nerved in *Cinna*), nerveless, or (in some *Agrostis* species) wanting.

---

[1] *Alopecurus, Cinna, Spartina,* and *Holcus* among our grasses, have the rachilla articulated below the first pair of glumes, and the spikelets fall off entire.

This is, next to the *Festuceæ*, the largest tribe in the order, numbering seven hundred species arranged in forty-six genera. The species are distributed throughout all the temperate and colder regions of the world and many occur within the Tropics. The genus *Agrostis*, from which the tribe derives its name and from which comes the word "agrostologist," has about one hundred species, found in all parts of the world, especially in the north temperate zone. Some of our most important meadow grasses—notably Herd's-grass and timothy—belong to this tribe.

Aristida Linn.*
Stipa Linn.*
Oryzopsis Michx.*
Eriocoma.*
Milium Linn.*
Muhlenbergia Schreb.*
Brachyelytrum Beauv.*
Lycurus Kunth.
Pereilema Presl.
Heleochloa Host.*
Phleum Linn.*
Alopecurus Linn.*
Coleanthus Seid.
Phippsia R. Br.*
Sporobolus R. Br.*
Epicampes Presl.*
Polypogon Desf.
Limnodia L. H. Dewey.*
(*Thurberia* Benth.)
Arctagrostis Griseb.
Cinna Linn.*
Agrostis Linn.*
Gastridium Beauv.
Calamagrostis Roth.*
Ammophila Host.*
Calamovilfa Scribn.*
Apera Adans.
Lagurus Linn.

TRIBE IX.—*Aveneæ*.

Spikelets two- to several-flowered; outer empty glumes usually longer than the first floral glume; one or more of the floral glumes awned on the back or from between the teeth of the bifid apex; awn usually twisted or geniculate; the callus, and usually the joints of the rachilla, hairy.

A tribe comprising twenty-three genera and over three hundred species widely distributed in the temperate regions of both the Old and the New World, particularly abundant in South Africa and Australia, a few extending beyond the arctic circle.

Several of the species are valued as forage plants. Cultivated oats, *Avena sativa*, is the best-known example of this tribe.

Holcus Linn., in part.*
Aira Linn.*
Weingaertneria Bernh.*
(*Corynephorus* Beauv.)
Deschampsia Beauv.*
Trisetum Pers.*
Avena Linn.*
Arrhenatherum Beauv.*
Danthonia DC.*

TRIBE X.—*Chlorideæ.*

Spikelets one- to several-flowered in one-sided spikes or racemes; these racemes digitate or fasciculate, rarely solitary; flowering glumes usually keeled, entire and unawned, or toothed, and with one or three straight awns.

A small tribe of twenty-seven genera and one hundred and fifty-five species, characterized chiefly by the inflorescence, which is nearly that of *Paspalum*. The awns when present are not dorsal nor twisted, as in *Agrostideæ* and *Aveneæ*. Chiefly natives of tropical and subtropical countries; a few are widely distributed as weeds throughout the warmer parts of the world. A number are good turf-forming grasses, and are valued for grazing purposes. One of these is the celebrated buffalo-grass of the Western plains, which is remarkable for having the staminate and pistillate spikelets separate and in unlike inflorescences, either upon the same plant (monœcious) or upon different plants (diœcious).

Capriola Adans.*
(*Cynodon* Pers.)
Spartina Schreb.*
Campulosus Desv.*
(*Ctenium* Panzer).
Chloris Sw.*
Trichloris Fourn.*
Gymnopogon Beauv.*
Schedonnardus Steud.*
Bouteloua Lag.*
Beckmannia Host.*
Eleusine Gaertn.*
Dactyloctenium Willd.*
Leptochloa Beauv.*
Bulbilis Raf.*
(*Buchloë* Engelm.)

Tribe XI.—*Festuceæ.*

Spikelets two- to many-flowered, usually hermaphrodite, pedicellate in racemes or panicles, the latter sometimes dense and spike-like; flowering glumes usually longer than the empty ones, awnless or with one to several straight (rarely bent) awns which are either terminal or borne just below the apex.

This is the largest tribe in the order, numbering seventy-six genera and about seven hundred and twenty-five species. It contains the most important meadow grasses of the temperate regions as well as the more prevalent grasses of the higher mountains within the Tropics. The genus *Poa*, which includes Kentucky blue-grass, Texas blue-grass, etc., numbers one hundred species, and an equal number of species are included in the genus *Eragrostis*. The Fescues number eighty species, and the tribe takes its name from this genus—*Festuca*. Orchard grass, *Dactylis glomerata*, is a well-known example of this tribe.

Pappophorum Schreb.*
Cottea Kunth.*
Cathestecum Presl.*
Scleropogon Philippi.*
Monanthochloë Engelm.*
Munroa Torrey.*
Orcuttia Vasey.*
Gynerium HBK.
Arundo Linn.
Phragmites Trin.*
Blepharidachne Hack.
(*Eremochloë* S. Wats.)
Triodia R. Br.*
Sieglingia Bernh.
Redfieldia Vasey.*
Dissanthelium Trin.*
Molinia Schrank.
Eragrostis Host.*
Eatonia Raf.*
Koeleria Pers.*
Catabrosa Beauv.*
Melica Linn.*
Korycarpus Zea.*
(*Diarrhena* Raf.)
Pleuropogon R. Brown.*
Uniola Linn.*
Distichlis Raf.*
Briza Linn.*
Dactylis Linn.*
Cynosurus Linn.*
Lamarckia Moench.*
Poa Linn.*
Colpodium Trin.
Dupontia R. Br.
Scolochloa Link.
Graphephorum Desv.*
Panicularia Fabr.*
(*Glyceria* R. Br.)
Puccinellia Parl.*
Festuca Linn.*
Bromus Linn.

TRIBE XII.—*Hordeæ.*

Spikelets one- to many-flowered, usually hermaphrodite, sessile along the common rachis, forming a simple or compound spike;[1] glumes awned or awnless.

A small tribe of twenty genera and about one hundred and thirty species. It is an important division, however, for it includes rye, barley, and the many varieties of wheat. English and Italian Rye-grasses (*Lolium* species) are the chief meadow grasses of the tribe.

Nardus Linn.*
Lolium Linn.*
Lepturus R. Br.
Scribneria Hack.*
Agropyron Gaertn.*
Secale Linn.
Triticum Linn.
Hordeum Linn.*
Elymus Linn.*
Asperella Humb.*

TRIBE XIII.—*Bambuseæ.*

Spikelets two- to many-flowered (rarely only one-flowered) in racemes or panicles; empty glumes at the base of the spikelet two to several; flowering glumes many-nerved, awnless, or very rarely short-awned; culms woody, at least near the base, and perennial; leaf blade usually with a short petiole articulated with the sheath from which it finally separates.

A comparatively small tribe of twenty-three genera and about one hundred and eighty-five species. The species are confined chiefly to the region within the Tropics. Many of them are of very great importance to the natives of the countries where they grow. Manufactured articles of bamboo, either of use or for ornament, are now a part of the commerce of the world. The bamboos are remarkable for their woody stems and often arborescent or tree-like habit of growth, some of the species attaining the height of 25 to 30 m. In parts of India they form extensive forests. One species in this tribe has leaves 2 to 5 m. long by 10 to 25 cm. wide; another, a Cuban species, has leaves 5 to 8 cm. long and as fine as a horse hair. Fleshy and edible, apple-like fruits are borne by some of the species.

---

[1] Strictly the spike is simple when the sessile spikelets are one-flowered, and compound when they are more than one-flowered.

Arundinaria Michx.

F. L. S.

AMERICAN GRASSES—I.

(ILLUSTRATED.)

BY F. LAMSON-SCRIBNER.

METRIC MEASUREMENTS AND THEIR ENGLISH EQUIVALENTS.

The metric system adopted in this Bulletin is now quite generally employed in botanical and other scientific publications. For those unfamiliar with this system the following expression of equivalents may be useful:

1 millimètre (1 mm.) = one twenty-fifth of an inch—exactly 0.0394 inch.

1 centimètre (1 cm.) = nearly one-half of an inch; 10 cm. = about 4 inches.

1 décimètre (1 dm.) = about 4 inches, or 3 dm. = one foot.

1 mètre (1 m.) = about 3 feet 3⅜ inches—exactly 39.37079 inches

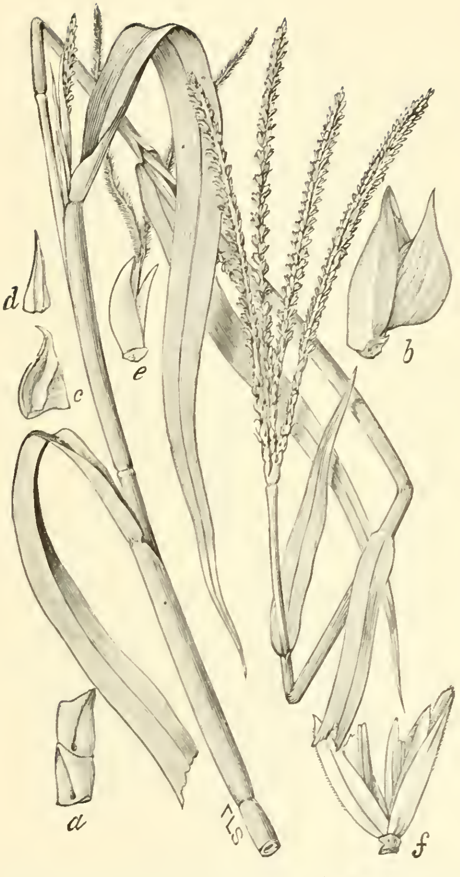


FIG. 1. **Tripsacum dactyloides** L. Gama-grass.—A stout, coarse, branching perennial 9 to 24 dm. high, with long and rather broad leaves and a spicate inflorescence, the spikes being 2 to 4 on the main stem and usually solitary on the branches.—Low meadows, moist thickets, ditches, etc.; Rhode Island to Florida, Kansas, and Texas. [Mexico.] April–October.

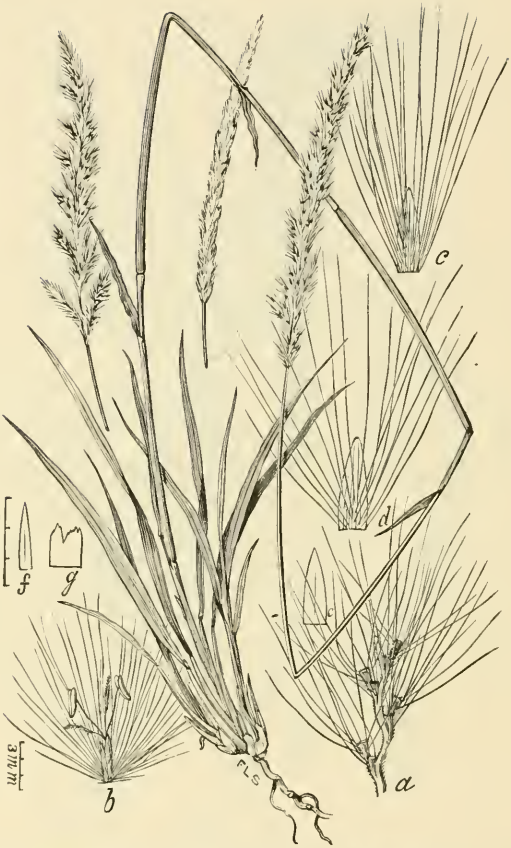


FIG. 2. **Imperata hookeri** Rupr. (*I. brevifolia* Vasey; *I. caudata* Scribn. not Trin.); Beal, Grasses N. Am., **2**: 22.—A stout, glabrous perennial 5 to 12 dm. high, with strong, creeping rootstocks, flat leaves, and elongated white-hairy, densely flowered panicles.—Western Texas, Nevada, New Mexico, Arizona, Southern California and southward.

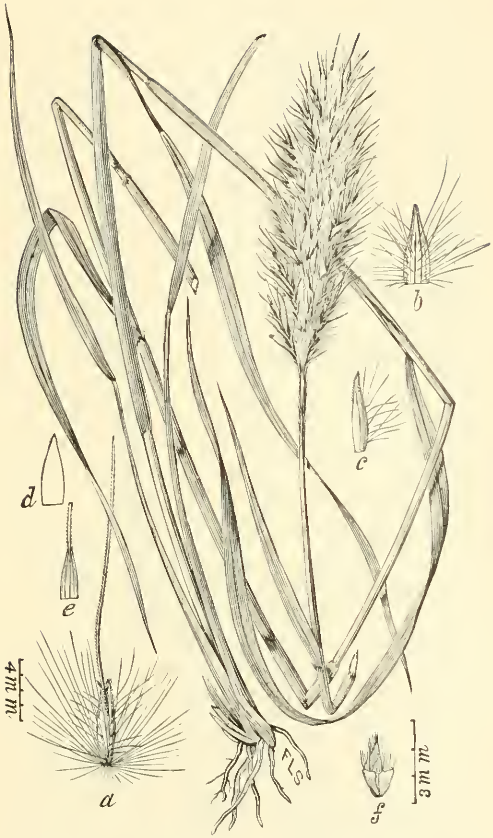


Fig. 3. **Erianthus compactus** Nash in Bull. Torr. Bot. Club, **22**: 419; Britton and Brown, Ill. Fl., **1**: 99. Densely flowered Plume-grass.—A stout, erect perennial 12 to 24 dm. high, with long, narrow leaves and densely flowered, oblong, brownish or reddish panicles 10 to 15 cm. long, the branches spreading in anthesis.—Meadows and swamps, mostly near the coast; New Jersey to Virginia and Tennessee. August–October.

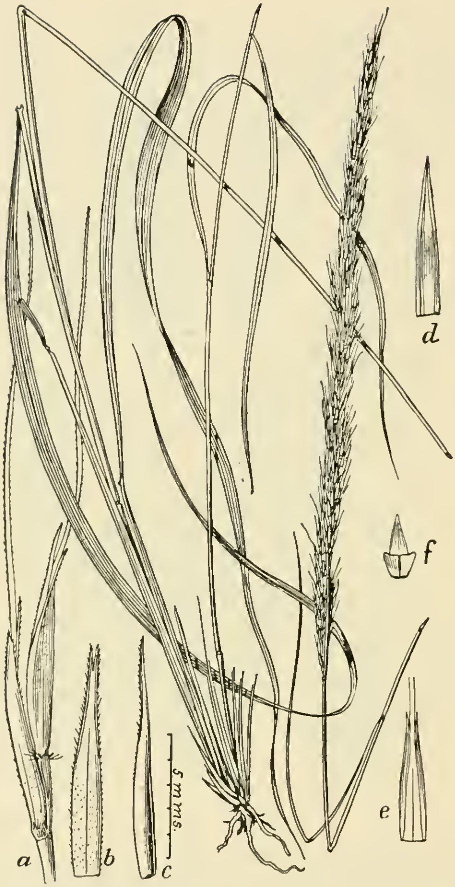


FIG. 4. **Erianthus strictus** Baldw.; Beal, Grasses N. Am., **2**: 29.—A stout, erect perennial 12 to 24 dm. high, with long, narrow, flat leaves and strict, bearded (with awns), but not hairy, panicles, 20 to 40 cm. long.—River bottoms, Tennessee and Georgia to Mississippi and Texas. September, October.

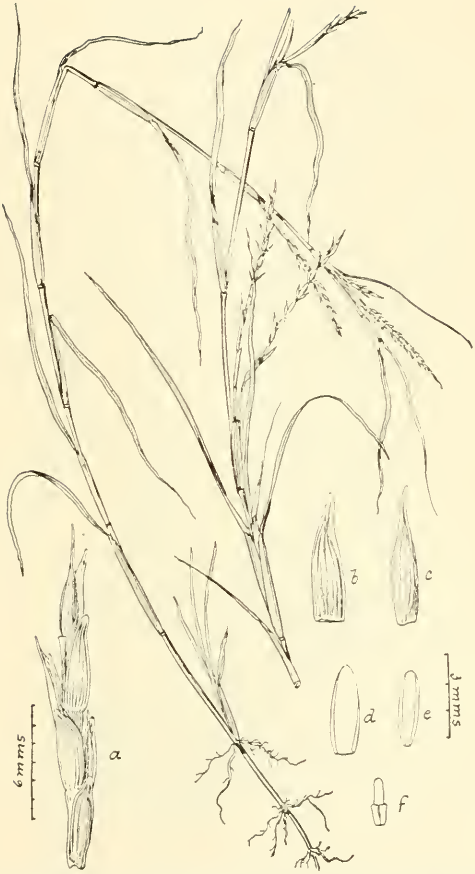


FIG. 5. **Manisuris compressa** (L. f.) Kuntze (*Rottboellia compressa* L. f.; *Hemarthria fasciculata* Kunth). MAT-GRASS.—A creeping perennial, with ascending and usually much branched, flattened culms 10 to 14 dm. high, and numerous slender spikes.—River banks, southwestern Texas. [Tropical and subtropical regions of both hemispheres.] September.

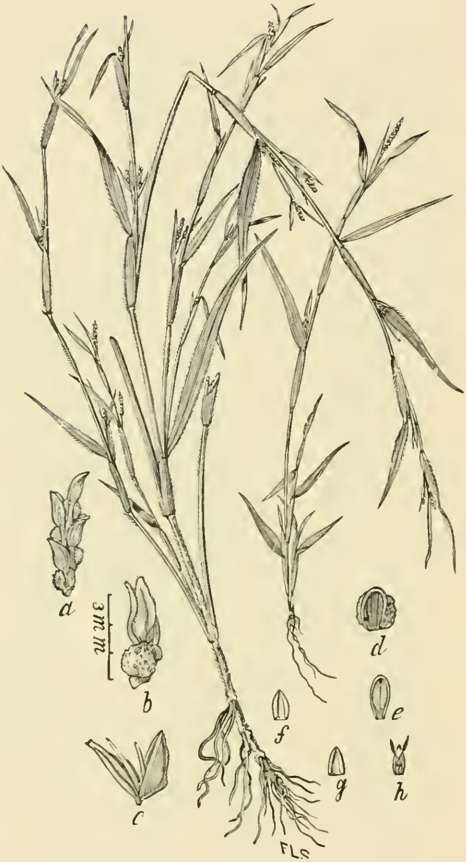


Fig. 6. **Hackelochloa granularis** (Sw.) Kuntze (*Manisuris granularis* Sw.; *Cenchrus granularis* Linn.); Beal, Grasses N. Am., **2**: 33. Lizard-tail-grass.—A much-branched, leafy annual, 3 to 12 dm. high, with numerous slender spikes in irregular, leafy panicles.—A weed in all tropical countries, extending northward into the warmer parts of the Southern and Southwestern States.

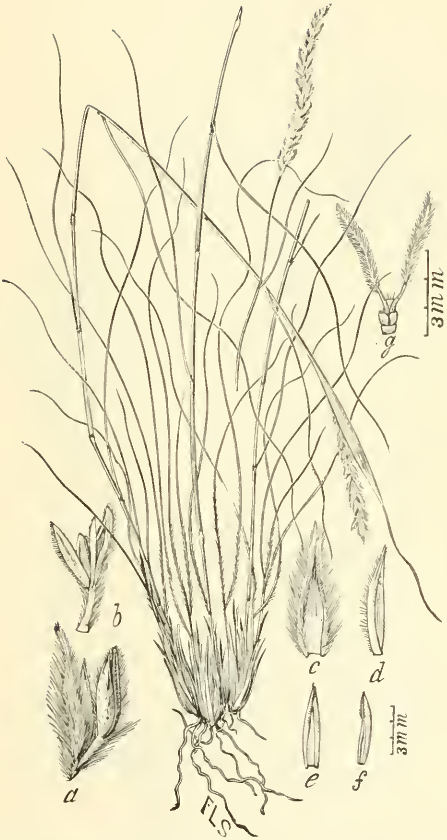


FIG. 7. **Elionurus barbiculmis** Hack.; Beal, Grasses N. Am., **2**: 37.—A slender, erect perennial 4 to 7 dm. high, with very narrow, filiform, hairy leaves and silky-villous, solitary spikes terminal on the culm or its branches.—Rocky hills and canyons, western Texas to Arizona. [Northern Mexico.] June–September.

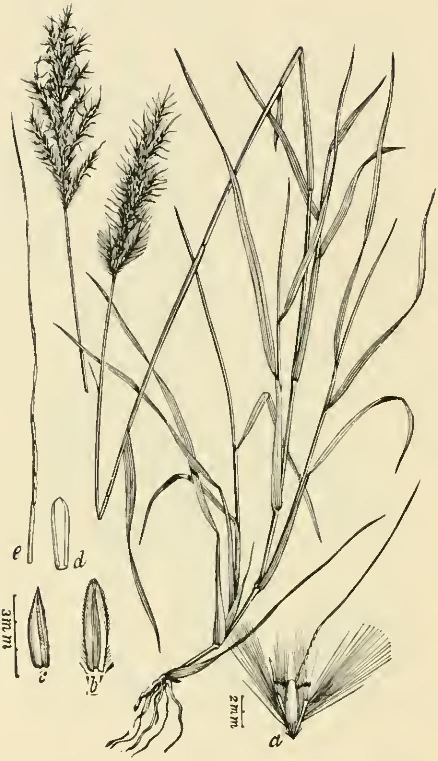


Fig. 8. **Andropogon saccharoides torreyanus** (Steud.) Hack; Britton and Brown, **1**: 103 (*Andropogon torreyanus* Steud.). Torrey's Silver Beard-grass.—A variable native perennial 3 to 9 dm. high, with rather long, usually glaucous, flat leaves, and narrow silvery-bearded panicles.—Dry prairies and mesas. Kansas to Texas, New Mexico, and Nevada. [Mexico.] July–October.

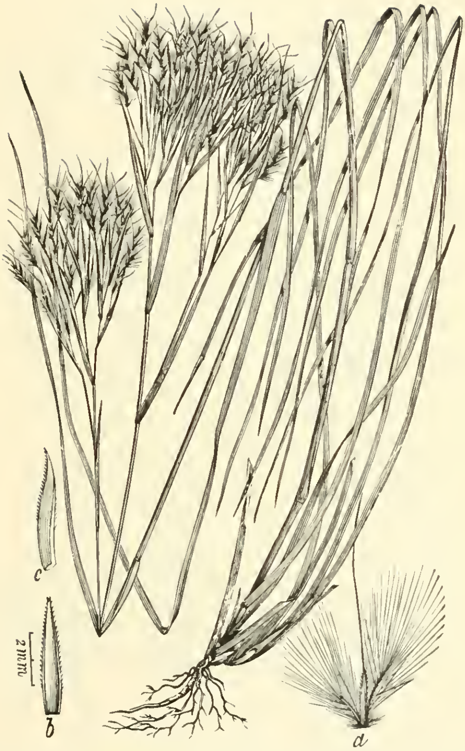


FIG. 9. **Andropogon glomeratus** (Walt.) B. S. P. (*Andropogon macrourus* Michx.). BROOK-GRASS.—A stout perennial 6 to 12 dm. high, with dense, more or less elongated panicles, the branches usually very much crowded.—Low grounds and marshes, southern New York to Florida, southern California and Nevada. [Mexico, Lower California, Cuba, and Jamaica.] September–January.

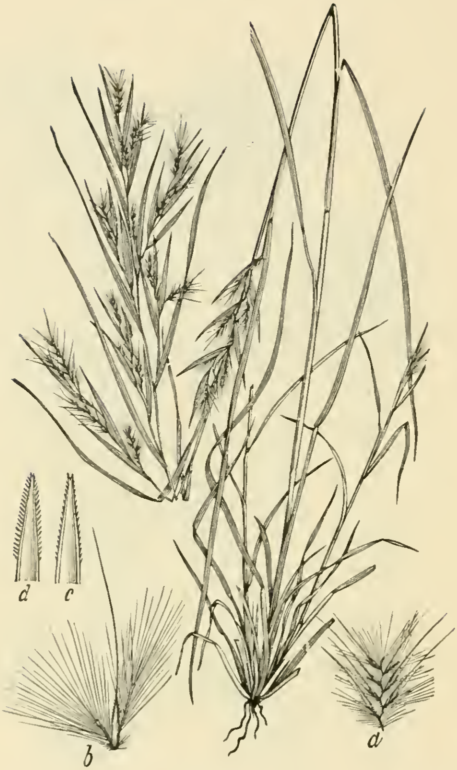


Fig. 10. **Andropogon virginicus** L. Broom Sedge.—A rigidly erect perennial 6 to 12 dm. high, with the culms flattened near the base, and narrow, elongated, and loosely branched panicles of silky-bearded racemes, for the most part partially inclosed within smooth, spathe-like bracts.—Old fields and borders of woods, usually in dry soil, Massachusetts to Florida and Texas. [Cuba.] August-October.

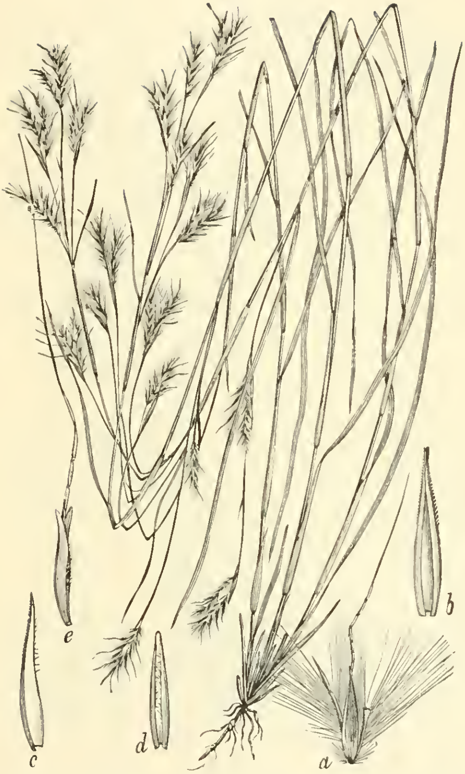


FIG. 11. **Andropogon argyræus** Schultes. SILVER-BEARD or SILVERY BEARD-GRASS.—A rather slender native grass 6 to 9 dm. high, with narrow leaves and silky-bearded racemes, which are in pairs, terminal on the culm or its branches.—In dry, sandy soil in open woods and along thicket borders from Delaware to Missouri and southward to the Gulf. August–October.

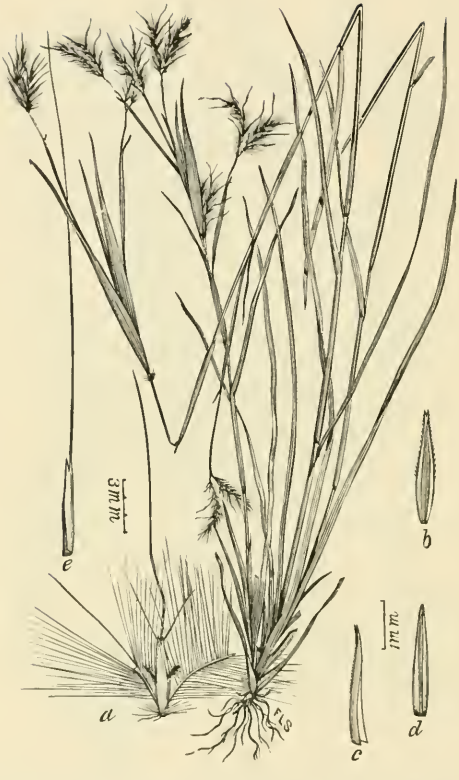


FIG. 12. **Andropogon elliottii** Chapm. ELLIOTT'S BROOM SEDGE.—A slender, upright perennial 6 to 9 dm. high, the plumose racemes in pairs or ternate and subtended by conspicuously inflated upper leaf sheaths.—Dry upland woods or low pine barrens, Delaware and Pennsylvania to central Florida and Texas. July-October.

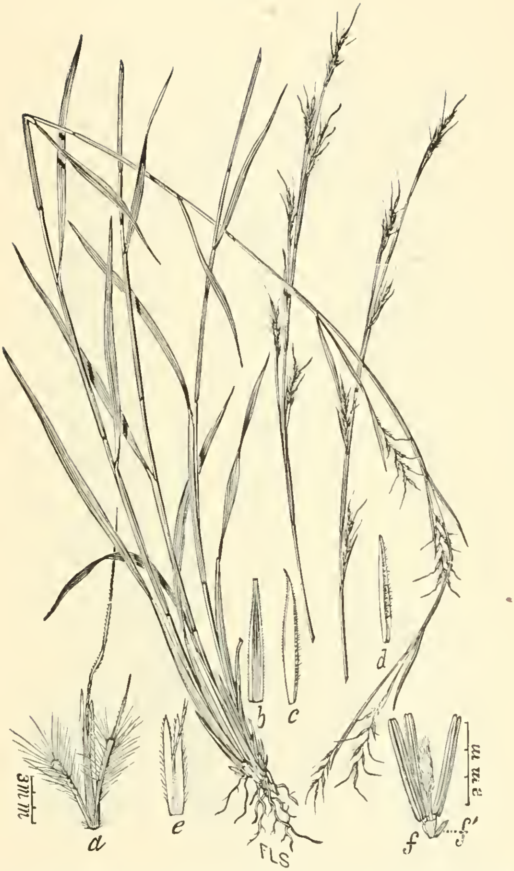


FIG. 13. **Andropogon scoparius** Michx. LITTLE BLUE-STEM.—A rather slender perennial 3 to 9 dm. high, the solitary racemes terminating the culms and branches.—Dry fields and borders of woods, New Brunswick westward to the Saskatchewan, southward to Florida, Texas, and southern California. [Mexico.] July–October.

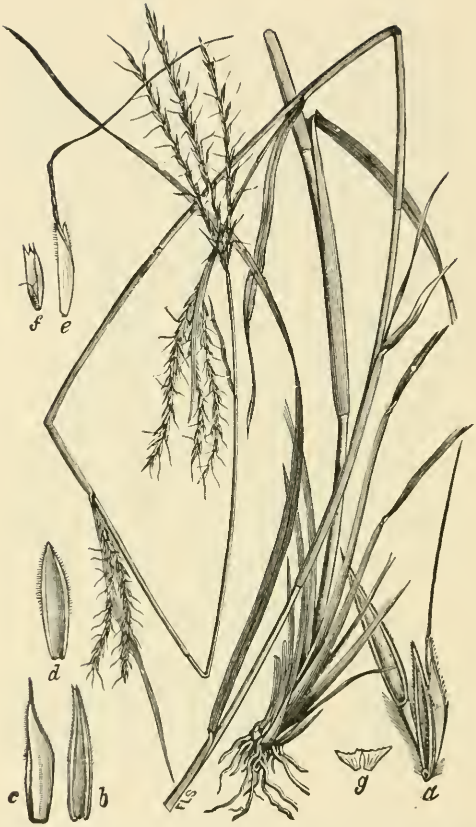


Fig. 14. **Andropogon provincialis** Lam. (*A. furcatus* Muhl.) Big Blue-stem.—A stout perennial 6 to 16 dm. high, with long leaves, and rather thick spikes 3 to 10 cm. long.—From the Rocky Mountains eastward to the Atlantic and southward to the Gulf of Mexico. August–October. Especially abundant and valued for hay in the prairie regions.

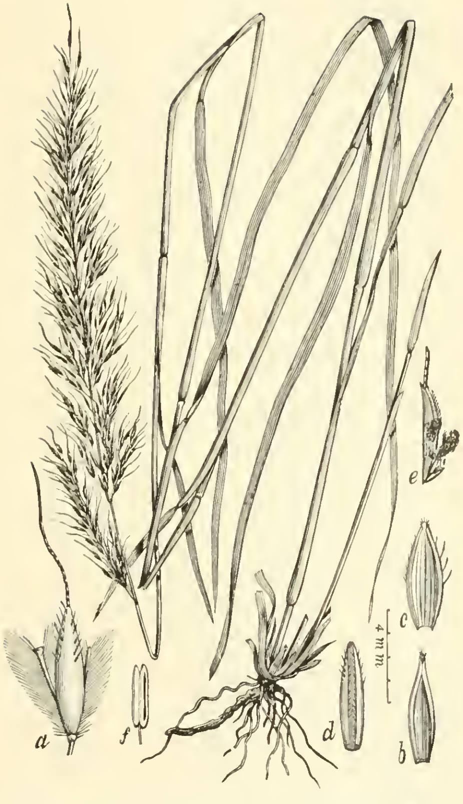


FIG. 15. **Andropogon nutans avenaceus** (Michx.) Hack. INDIAN GRASS.—A stout perennial 12 to 18 dm. high, with long leaf blades, and long, rather dense, usually somewhat nodding brownish panicles.—Dry fields, glades, and borders of woods, Ontario to South Dakota and Manitoba, south to Florida, Texas, and Arizona. [Mexico, Central and South America.] July–October.

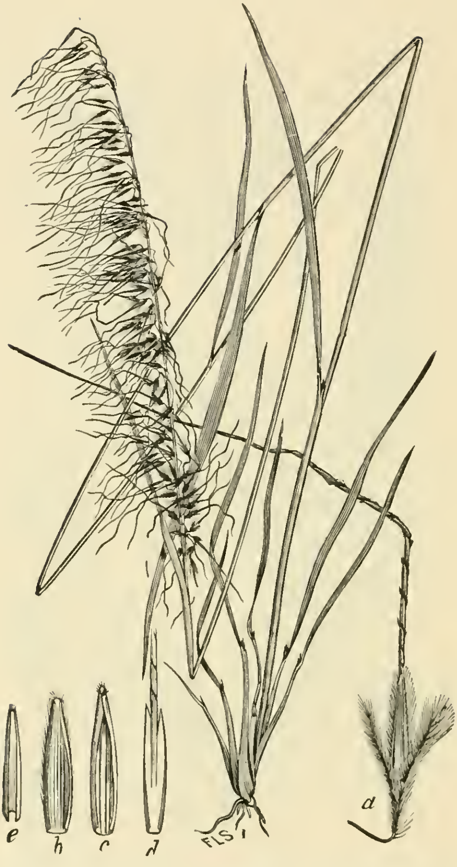


FIG. 16. **Andropogon unilateralis** Hack.; Beal, Grasses N. Am., **2**: 60. (*Andropogon secundus* Ell. not Willd.) BANNER SORGHUM.—A rather stout perennial, 6 to 12 dm. high, with narrow, one-sided, many-flowered panicles 18 to 25 cm. long, and long-awned spikelets.—Low pine lands, South Carolina, Florida. June–October.

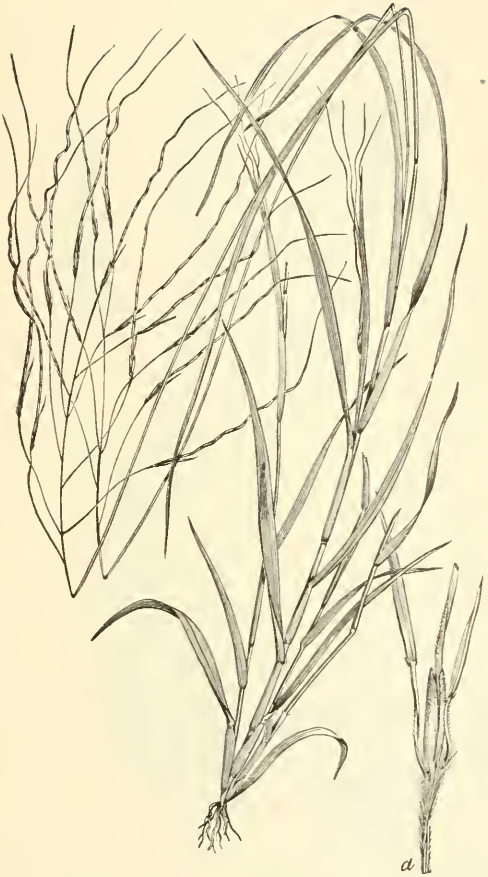


Fig. 17. **Andropogon pauciflorus** (Chapm.) Hack.; Beal, Grasses N. Am., **2** : 61. (*Sorghum pauciflorum* Chapm.). Few-flowered Sorghum.—A rather stout, branching, leafy annual, 6 to 12 dm. high, with few-flowered panicles and long-awned spikelets.—Dry fields, Florida. [Cuba.] October.

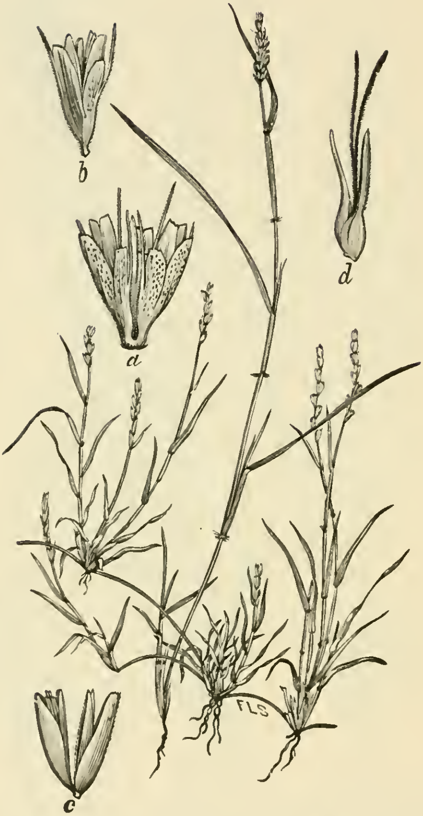


Fig. 18. **Hilaria cenchroides** HBK.; Beal, Grasses N. Am., **2**: 68. Curly Mesquite.—A slender, creeping perennial, with upright leafy branches 1 to 3 dm. high.—Dry prairies, mesas, and foothills, Texas to Arizona. [Mexico.] April–October. One of the most valuable of the native grasses for grazing.

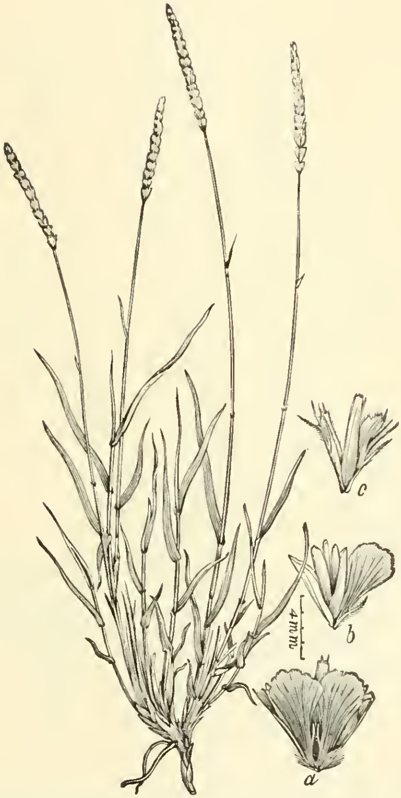


FIG. 19. **Hilaria mutica** (Buckl.) Benth.; Beal, Grasses N. Am., **2** : 69. BLACK GRAMA.—A smooth, branching perennial 4 to 6 dm. high, with densely flowered, usually straw-colored spikes about 5 cm. long.—Dry mesas, Texas to southern California. May–September. Valued for forage, especially for grazing.

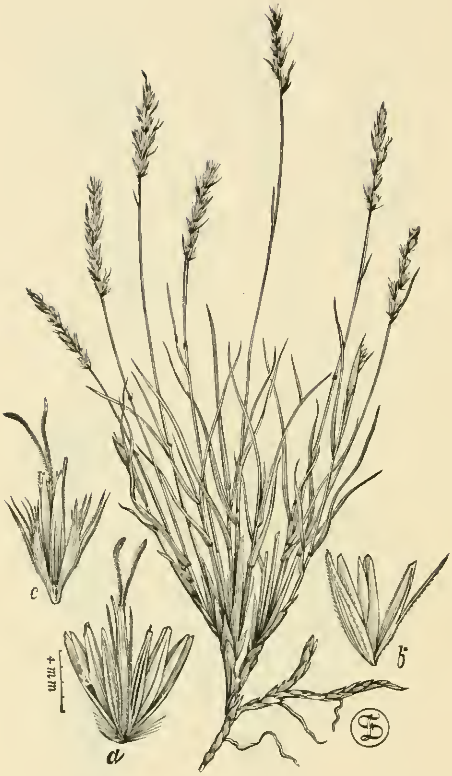


Fig. 20. **Hilaria jamesii** (Torr.) Benth.; Beal, Grasses N. Am., **2**: 70. Black Bunch-grass.—A rather coarse, branching perennial 3 to 5 dm. high, with erect, often purplish spikes 5 to 8 cm. long.—Mesas and table-lands of southern Colorado and Utah to New Mexico and southern California. March–July. A valuable hay or pasture grass.

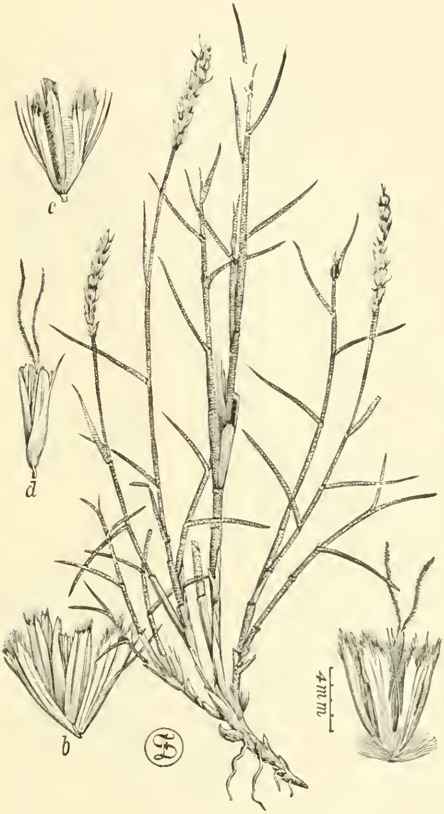


FIG. 21. **Hilaria rigida** (Thurb.) Vasey; Beal, Grasses N. Am., **2**: 68. (*Pleuraphis rigida* Thurb.) GALLETA.—A coarse, much-branched, and woody perennial 6 dm. high, growing in great clumps, somewhat resembling dwarf bamboos in habit —Deserts, southern Utah to Arizona and southern California. [Lower California.] May-July.

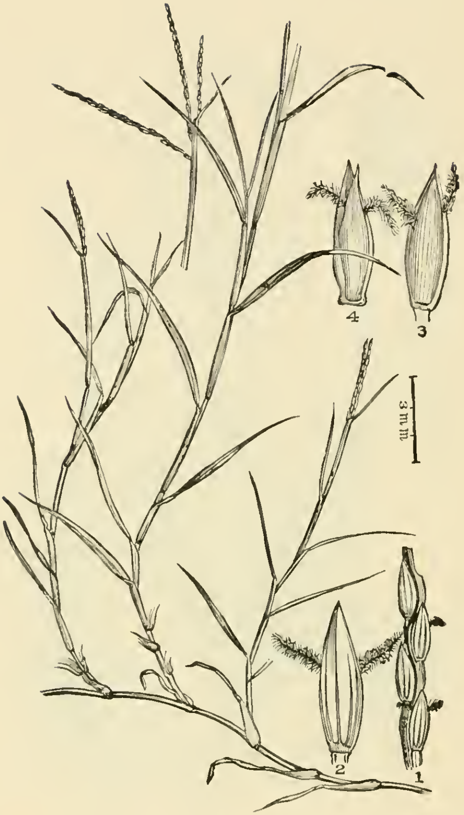


Fig. 22. **Reimaria oligostachya** Munro in Benth. Journ. Linn. Soc.; Beal, Grasses N. Am., **2**: 80. Creeping Reimaria.—An extensively creeping perennial, with flat leaves and upright flowering branches 2 to 4 dm. high, bearing two to four spikes 4 to 7 cm. long.—Ditches and brackish river shores, often in water, eastern Florida. [Cuba.] April-September.

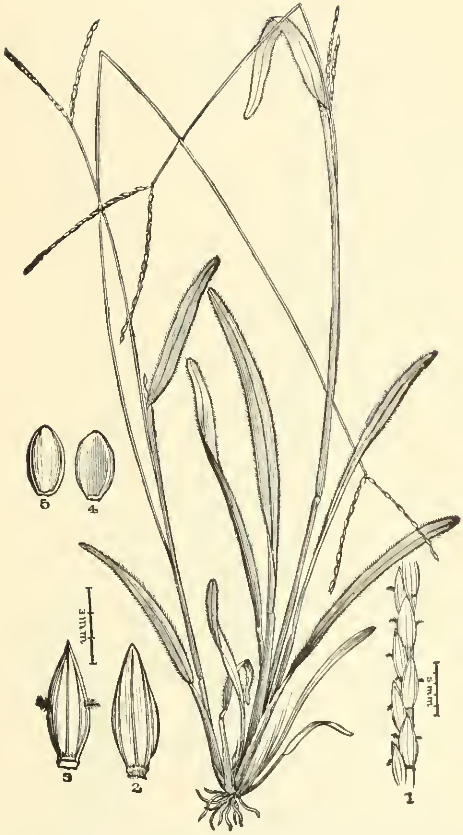


FIG. 23. **Paspalum paspaloides** (Michx.) Scribn. (*P. elliottii* S. Wats.; *P. digitaria* Poir.). ELLIOTT'S PASPALUM.—A soft perennial grass 5 to 8 dm. high, geniculate and more or less creeping at the base, with rather broad, flat leaves and slender spikes, which are usually in pairs.—Borders of ponds and ditches and in low pine barrens near the coast, Maryland to Texas. April-August.

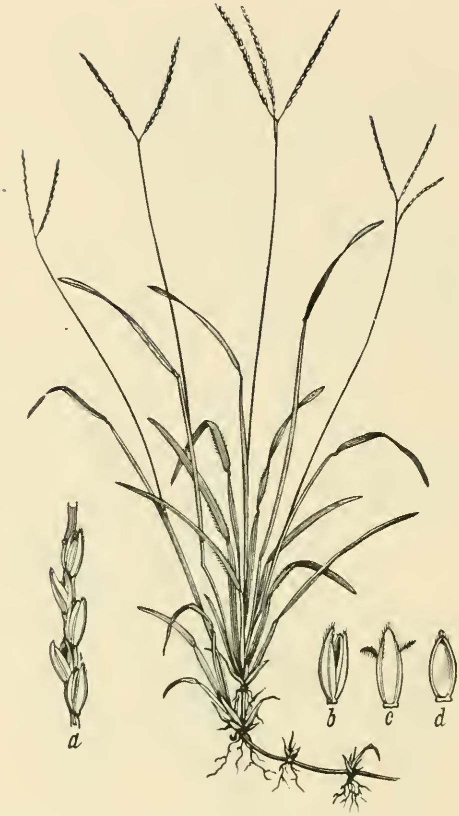


FIG. 24. **Paspalum compressum** (Sw.) Nees. (*P. platycaule* Poir.). LOUISIANA OR CARPET-GRASS.—A slender, erect, or more frequently prostrate and extensively creeping perennial, rooting at the nodes and sending up numerous leafy or flower-bearing branches 1.5 to 6 dm. high, with 2 to 6 subdigitate slender spikes and small, acutish spikelets.—Low ground and moist pastures, abundant near the coast from Virginia to Texas. [Mexico, Central and South America, and West Indies.] April–October. A valuable pasture grass.

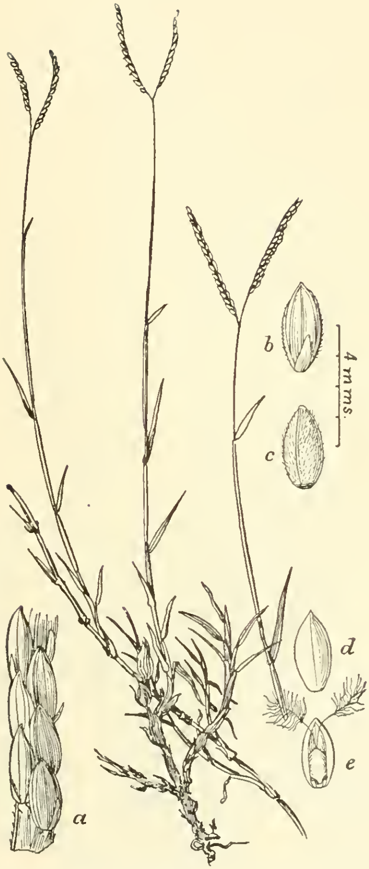


FIG. 25. **Paspalum distichum** L. KNOT-GRASS.—A low, creeping, somewhat succulent perennial, with flat leaves and two spikes at the apex of the upright flower-bearing branches, which are 1 to 3 dm. high. Habit of growth resembling Bermuda-grass.—Ditches and muddy or sandy shores, Virginia and Missouri to Florida, Texas, and southern California; northward on the Pacific Coast to Oregon. [Widely distributed in tropical and subtropical regions.] April-October.

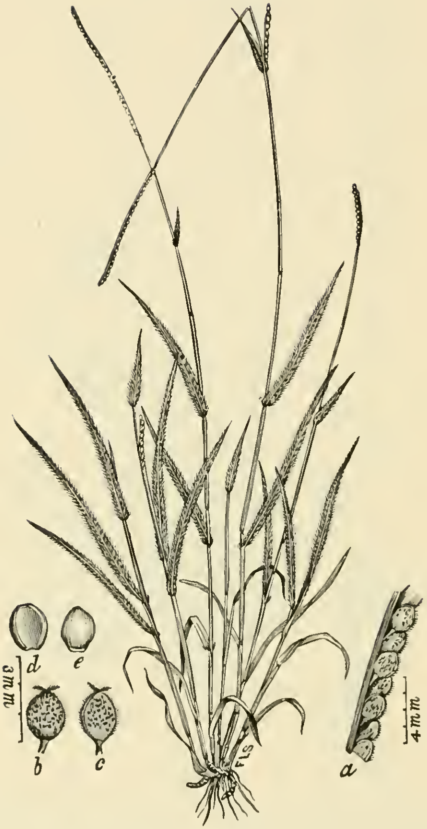


FIG. 26. **Paspalum setaceum** Michx. SLENDER PASPALUM.—A slender, erect, or ascending native perennial, usually about 6 dm. high, with flat, often hairy leaves, and slender, small-flowered spikes.—Dry, sandy fields and pine barrens, Massachusetts to northeastern Nebraska, Texas and Florida. April–October.

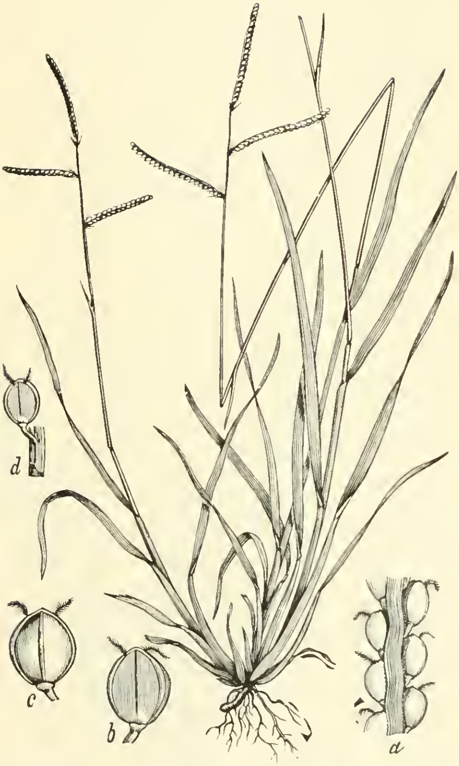


FIG. 27. **Paspalum læve** Michx. SMOOTH PASPALUM.—Perennial, with ascending culms, often geniculate at base, 3 to 9 dm. high, with smooth or pilose leaf sheaths and blades, and 3 to 7 spreading spikes 5 to 10 cm. long. Low, often wet, ground, Rhode Island to Florida, eastern Texas and Missouri. June–October.

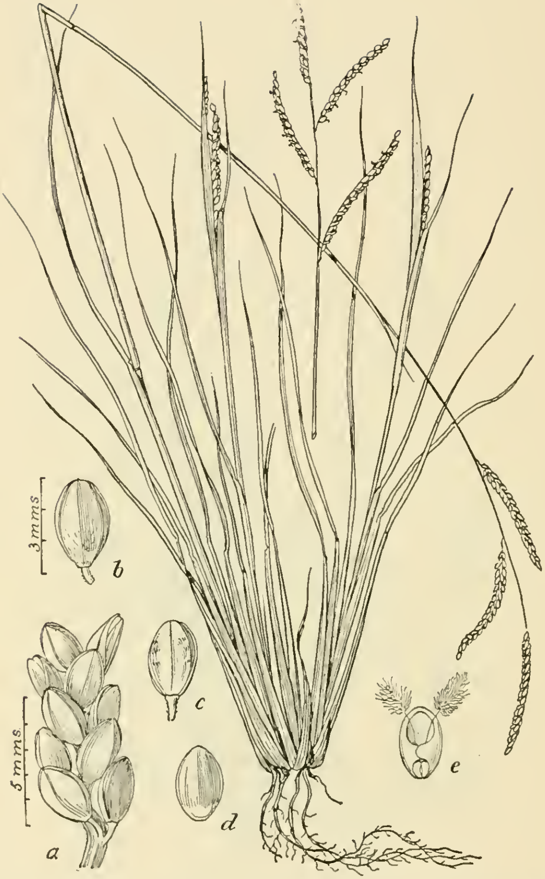


FIG. 28. **Paspalum plicatulum** Michx.; Beal, Grasses N. Am., **2**: 90. WRINKLE-FLOWERED PASPALUM.—An erect or ascending perennial 3 to 6 dm. high, with smooth or flat leaves and 5 to 7 rather densely flowered racemes. The second glume is usually plicate or wrinkled.—Dry fields and open pine woods, Georgia and Florida to Texas. [Mexico, Central and South America, and West Indies.] April–October.

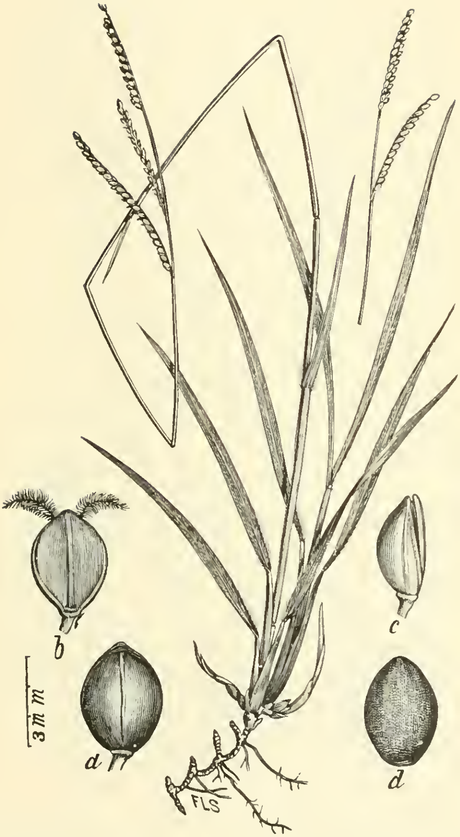


FIG. 29. **Paspalum difforme** Le Conte; Vasey Proc. Acad. Nat. Sci. Phila. 1886, 286.—A stout perennial, from creeping rootstocks. Allied to *P. floridanum*, but less robust, with shorter leaves and spikes.—Dry pine barrens near the coast, North Carolina to Florida and westward to Texas. June–October.

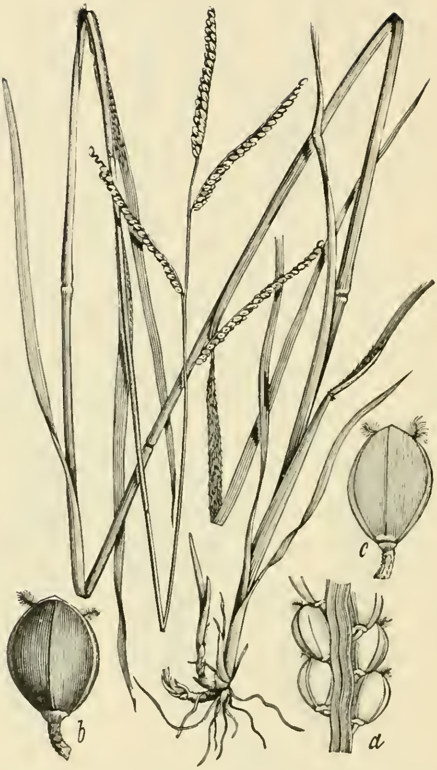


FIG. 30. **Paspalum floridanum** Michx. FLORIDA PASPALUM.—A stout, erect grass 9 to 12 dm. high, often glaucous, with long leaves, smooth or villous sheaths and blades, and large spikelets. Dry or moist low ground, Delaware to Florida, Texas, Kentucky, and Indian Territory. June–October.

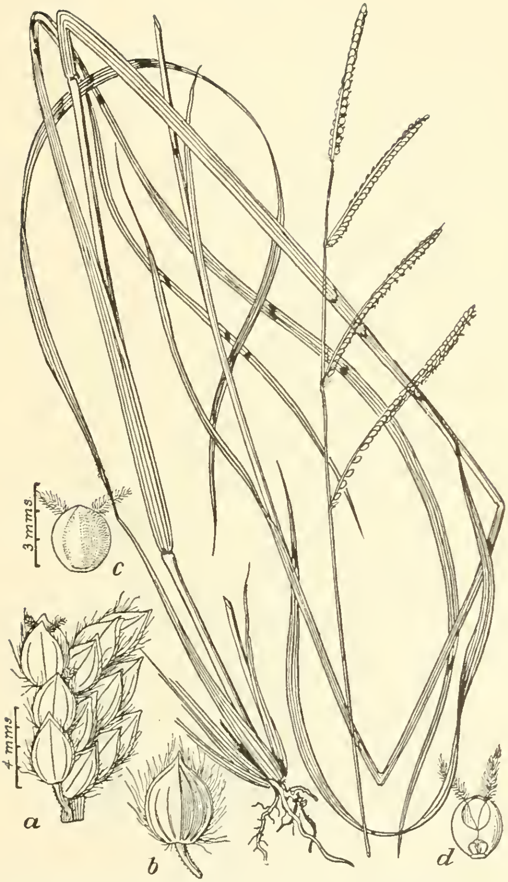


FIG. 31. **Paspalum dilatatum** Poir. (*P. ovatum* Nees). LARGE WATER-GRASS.—A somewhat coarse, leafy perennial, growing in clumps 6 to 15 dm. high, bearing 2 to 10 more or less spreading racemes of hairy spikelets.—In meadows, waste ground, and along ditches, southeastern Virginia to Florida, west to Texas; apparently naturalized. [South America.] July-October.

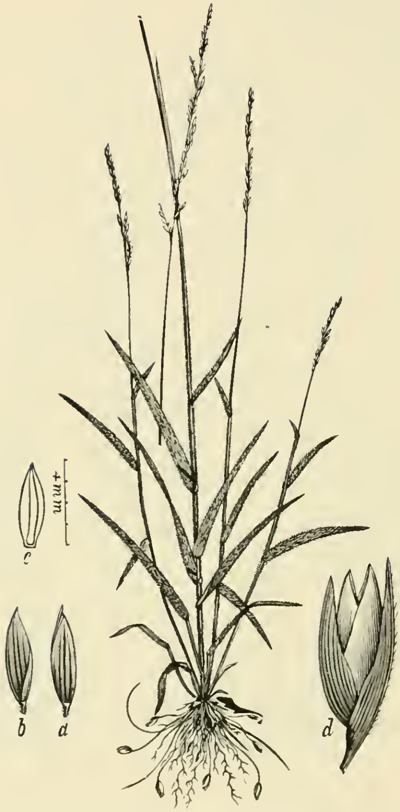


FIG. 32. **Amphicarpon purshii** Kunth. PURSH'S AMPHICARPON.—An erect, tufted perennial 3 to 12 dm. high, with hispid sheaths and leaves and contracted panicles. Fertile spikelets solitary and subterranean.—Pine barrens and cranberry bogs near the coast, New Jersey. August, September.

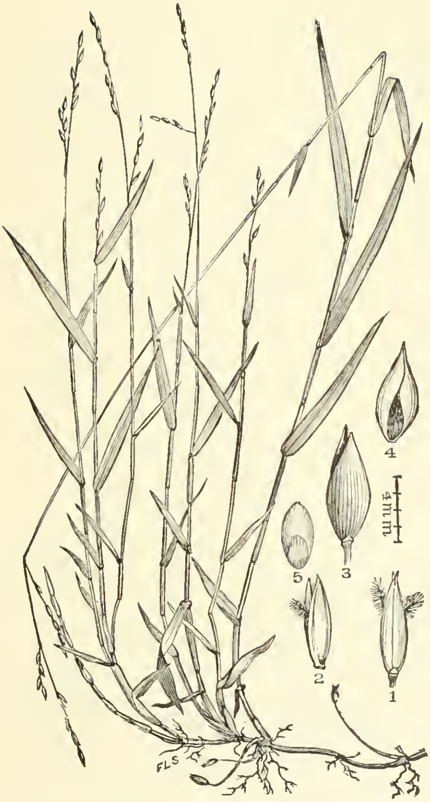


FIG. 33. **Amphicarpon floridanum** Chapm.; Beal, Grasses N. Am., **2**: 100. FLORIDA AMPHICARPON.—A pale-green, smooth perennial 3 to 9 dm. high, from creeping rootstocks, with flat leaves and narrow panicles 10 to 20 cm. long. Fertile spikelets on subterranean branches.—Moist pine barrens and sandy shores, Florida (throughout the State). July-September.

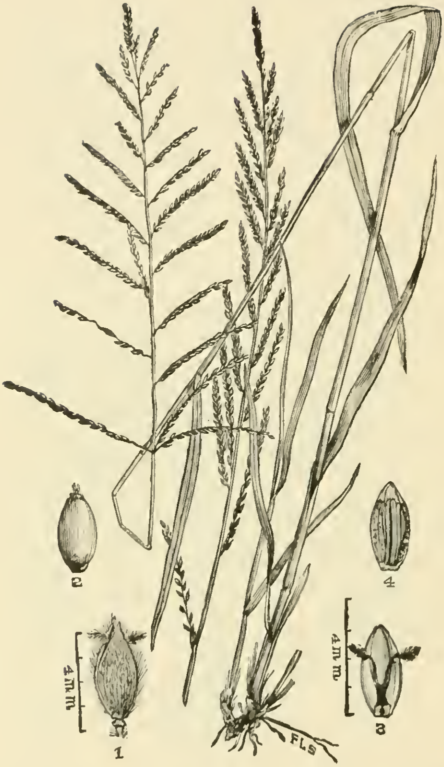


FIG. 34. **Eriochloa mollis** (Michx.) Kunth. (*Panicum molle* Michx.), Beal, Grasses N. Am., **2**: 102. SOFT WOOL-GRASS.—A perennial 10 to 20 dm. high, with long, flat leaves and open panicles of numerous, more or less spreading racemes 3 to 6 cm. long.—Brackish marshes and shores, South Carolina to Florida. April–September.

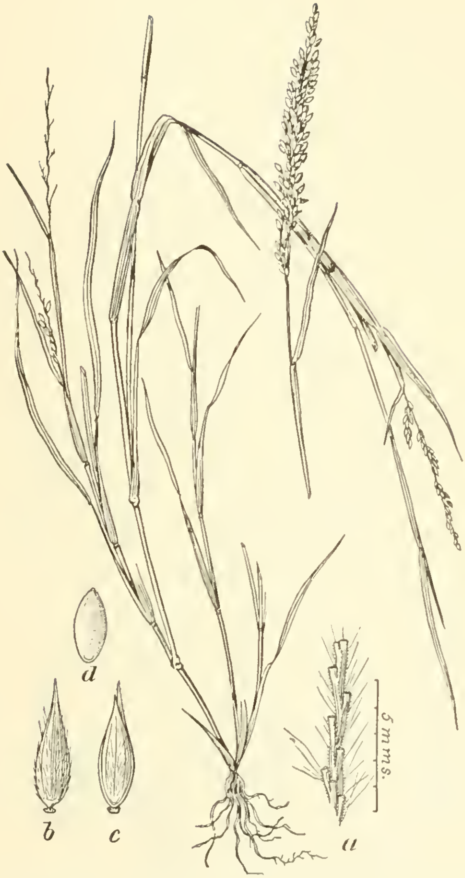


FIG. 35. **Eriochloa punctata** (L.) W. Hamilt. EVERLASTING-GRASS.—A rapid-growing, smooth and somewhat succulent perennial, with more or less branching culms 6 to 12 dm. high, flat leaves and narrow panicles 5 to 10 cm. long.—Low, rich land, moist soil, prairies, etc., Kansas to Texas and Arizona. [Tropical America, Asia, and Australia.] June-September.

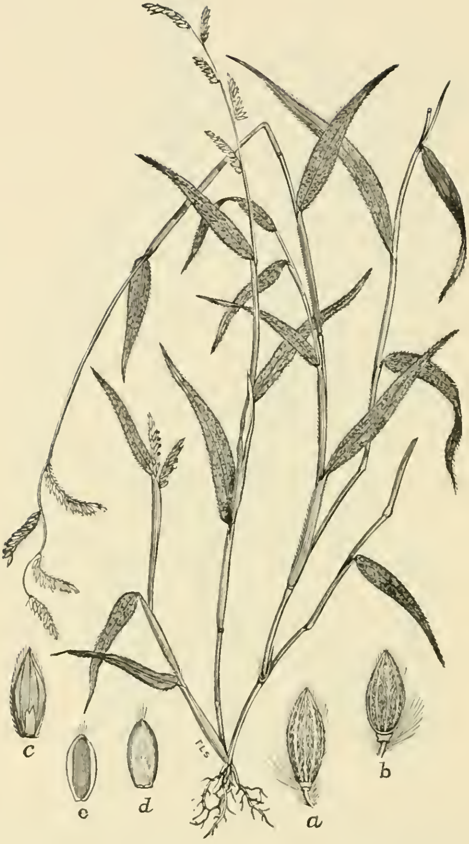


FIG. 36. **Eriochloa lemmoni** Vasey & Scribn.; Beal, Grasses N. Am., **2**: 101. LEMMON'S WOOL-GRASS.—A softly pubescent perennial 3 to 6 dm. high, with rather broad leaves and a short panicle composed of about 6 spreading spikes 2 to 3 cm. long.—Arizona. [Northern Mexico.] August–November.

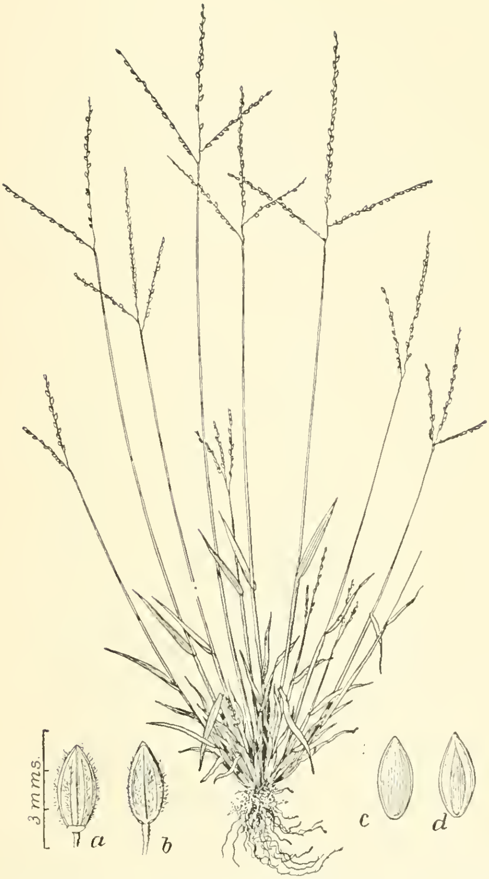


FIG. 37. **Panicum lineare** Krock (*Panicum glabrum* Gaud.; *Syntherisma tinearis* Nash). SMOOTH CRAB-GRASS.—A slender, glabrous annual 1.5 to 3.5 dm. high, with culms which are much branched below, flat leaves, and 2 to 6 slender diverging spikes.—Naturalized in waste and cultivated land; Nova Scotia to Ontario and South Dakota, south to Florida and Texas. [Europe.] August–October.

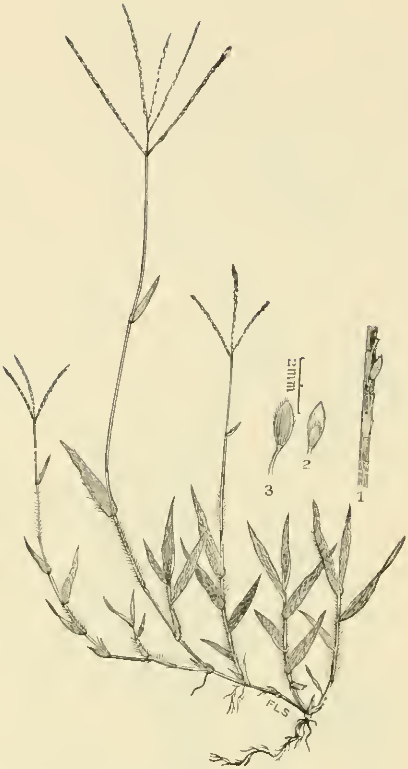


Fig. 38. **Panicum serotinum** (Walt.) Trin. (*Syntherisma serotina* Walt.; *Digitaria serotina* Mx.). Little Crab-grass.—An extensively creeping annual or biennial, with flat, hairy leaves, and slender spikes digitate at the apex of the ascending culms, which are 1 to 3 dm. high.—Low, sandy ground, roadsides, pastures, and cultivated fields near the coast, Delaware to Mississippi; on ballast at Philadelphia. June–August.

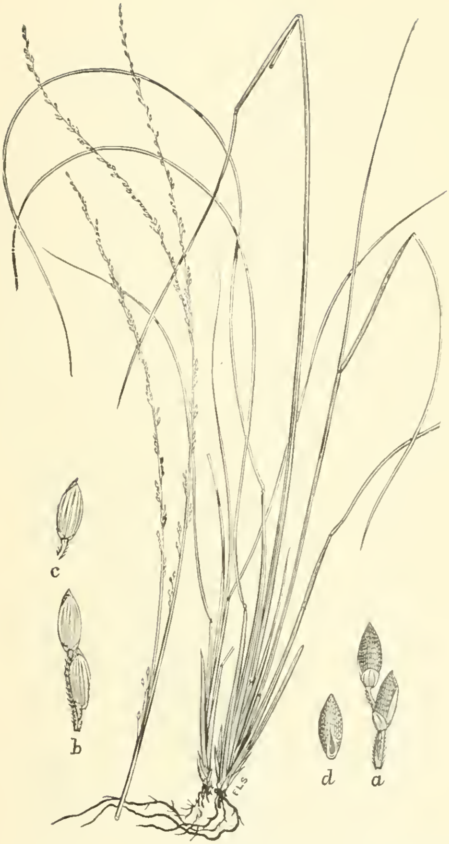


FIG. 39. **Panicum gracillimum** Scribn.; Bull. Torr. Bot. Club. **23**: 146. SLENDER PANICUM.—A slender perennial 3 to 9 dm. high, with very narrow, elongated leaves and small, glabrous spikelets, racemose along the main axis and its branches, which are approximate near the apex of the culm. Outer glumes glabrous.—High pine lands, Lake County, Florida. (1192, Nash.) July.

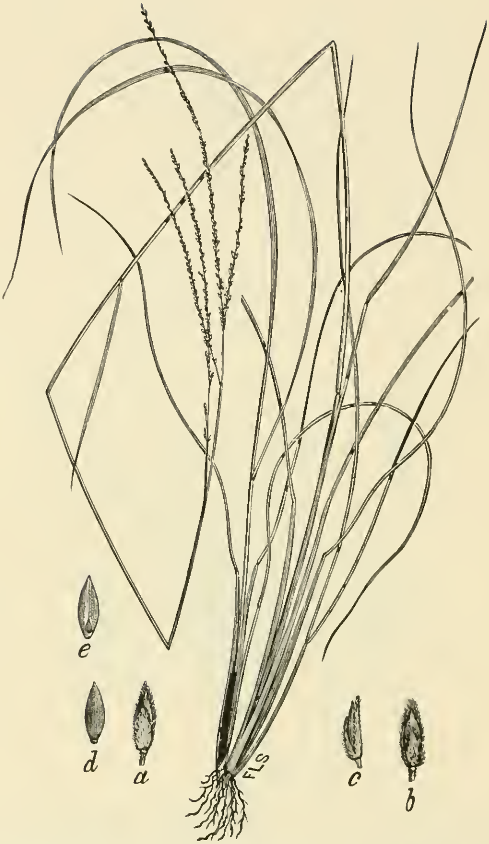


FIG. 40. **Panicum leucocomum** Scribn. (P. phaeothrix in ed. 1). SILVERY PANIC-GRASS.—A slender perennial about 9 dm. high, with long, narrow leaves and very slender, rather loosely flowered racemes 10 to 20 cm. long, approximate near the apex of the culm. Outer glumes densely clothed with soft white hairs.—High pine lands, Florida. (Nash, 1155.) July.

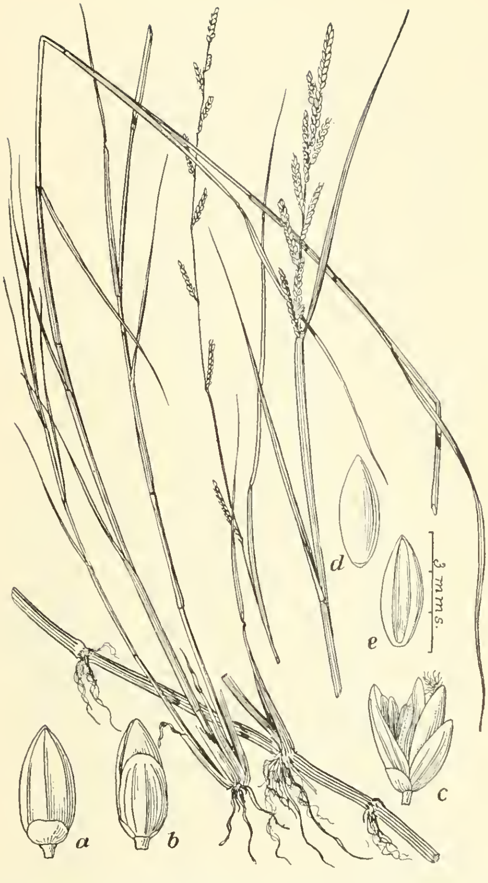


FIG. 41. **Panicum paspaloides** Pers.; Beal, Grasses N. Am., **2**: 114. SOUTHERN WATER-GRASS.—A rather stout, smooth, and more or less branching perennial 6 to 9 dm. high, often creeping at the base, with long, flat leaves, and ten to twenty alternate, one-sided spikes 2 to 3 cm. long.—About ponds and in standing water, southern Florida; Texas. [In tropical countries of both hemispheres.] May–July.

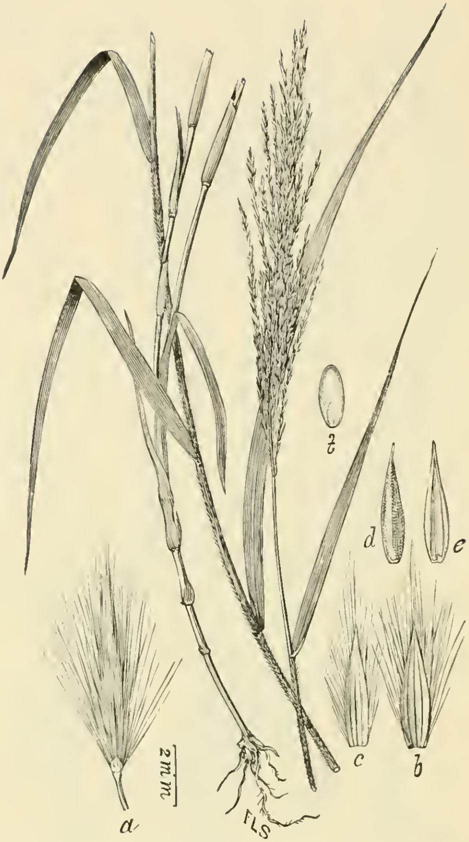


Fig. 42. **Panicum lanatum** Rottb. (*P. leucophæum* HBK.); Beal, Grasses N. Am., **2**: 111. Cotton-grass.—A rather stout, more or less branching leafy perennial 6 to 12 dm. high, with narrow, soft-hairy panicles.—Cultivated ground, river banks, and coral soil on keys, central and southern Florida; on ballast at Mobile, Ala. [Widely distributed in tropical America; Australia; Africa.] May-October.

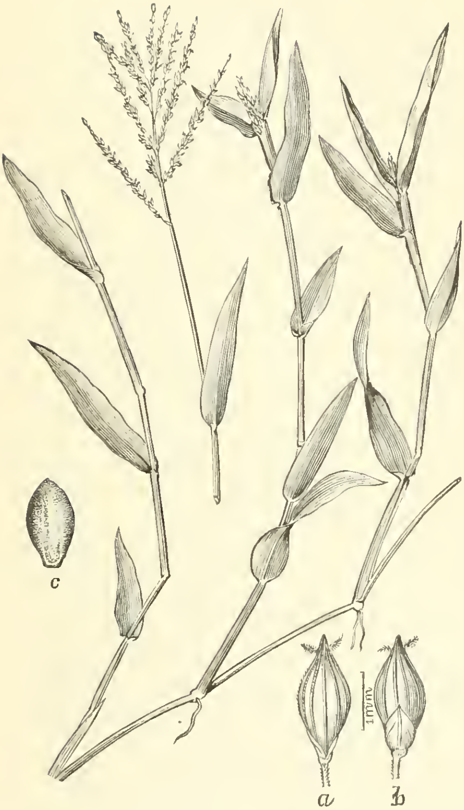


FIG. 43. **Panicum grossarium** L.; Beal, Grasses N. Am., **2**: 116. JAMAICA CRAB-GRASS.—Apparently an annual, with much-branched, ascending culms 3 to 6 dm. long, broad, lanceolate leaves and spreading panicles of a few simple racemes of glabrous spikelets.—Ballast ground, Philadelphia. Adventive. [West Indies.] September. Cultivated in grass garden, and apparently valuable.

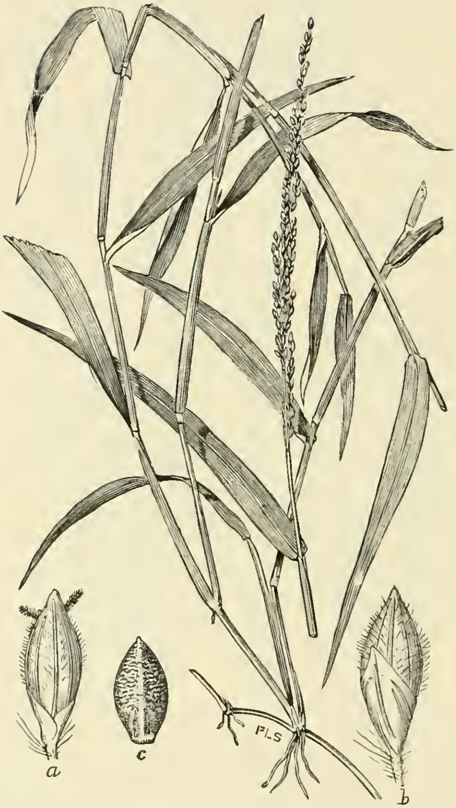


FIG. 44. **Panicum texanum** Buckl.; Beal, Grasses N. Am., **2**: 117. TEXAS MILLET.—A branching, leafy annual 6 to 12 dm. high, with flat leaves and narrow panicles 1.5 to 2 dm. long.—Texas. September.

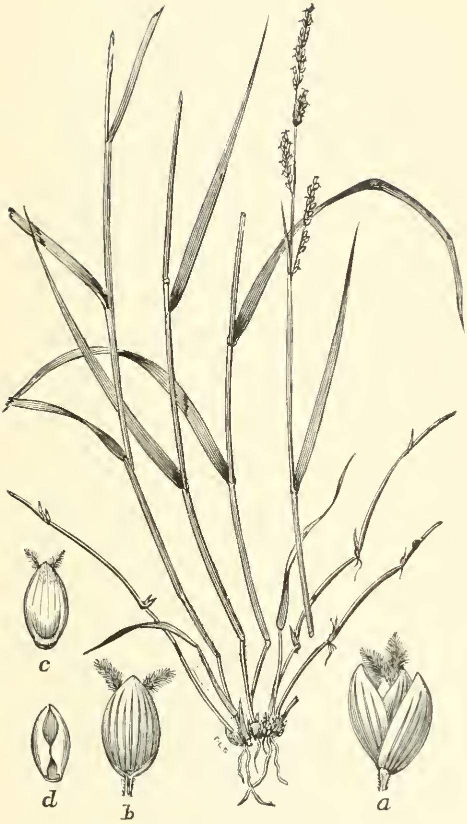


FIG. 45. **Panicum obtusum** HBK.; Beal, Grasses N. Am., **2**: 115. VINE MESQUITE-GRASS.—Stoloniferous perennial, the runners often 24 to 30 dm. long; the upright flowering branches 3 to 6 dm. high. Panicle of three to five erect racemes, bearing rather large obtuse spikelets.—Irrigated lands, low valleys, chiefly in the shade of trees and shrubs, Kansas and Colorado to Texas, New Mexico, Arizona, and southward. June–September.

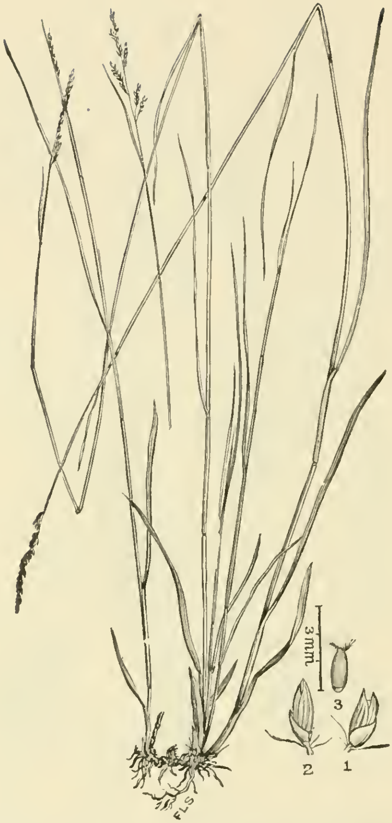


Fig. 46. **Panicum stenodes** Griseb. (*P. anceps strictum* Chapm.); Beal, Grasses N. Am., **2**: 126. Small-jointed Panic-grass.—A slender, erect, glabrous perennial, with wiry stems 5 to 8 dm. high, rigid, involute leaves, and narrow, simple panicles 4 to 8 cm. long.—Moist, sandy pine barrens near the coast, Florida to Texas. [Cuba and San Domingo.] July–October.

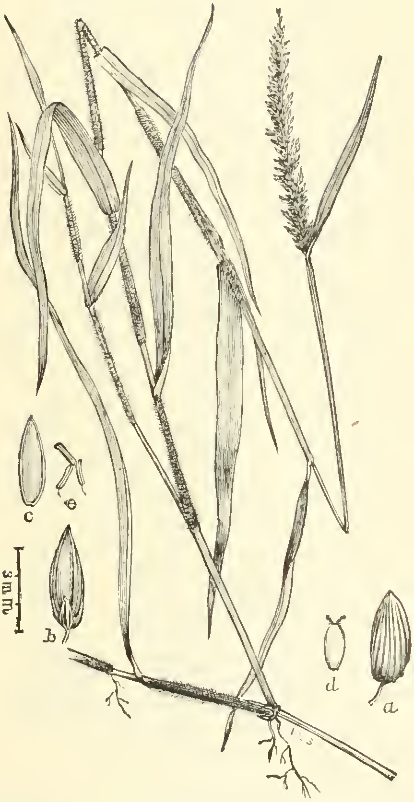


Fig. 47. **Panicum gibbum** Ell. Gibbous Panic-grass.—A stoloniferous, branching perennial 3 to 9 dm. high, with narrowly lanceolate, flat leaves, and densely flowered spike-like panicles 10 to 15 cm. long.—Low, wet grounds, Virginia to Florida, Tennessee, Louisiana, and Indian Territory. [Cuba.] June–October.

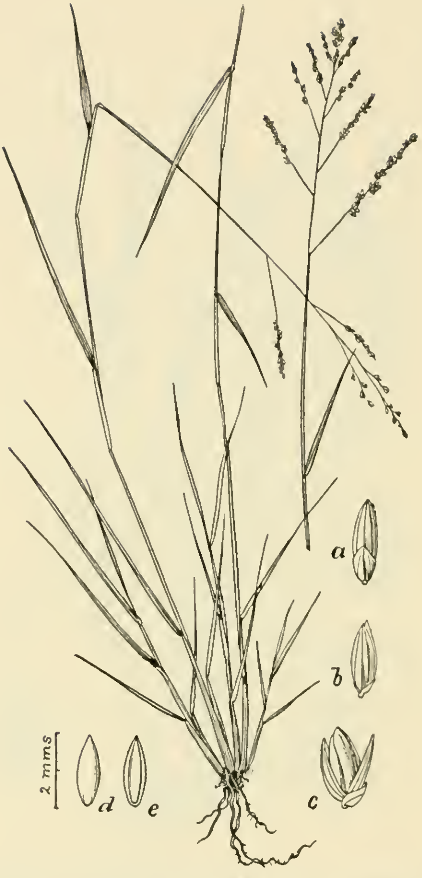


FIG. 48. **Panicum melicarium** Michx. (*P. hians* Ell.); Beal, Grasses N. Am., **2** : 127.—A smooth, slender, usually erect perennial 2 to 5 dm. high, with narrow, flat leaves and simple, open panicles 6 to 15 cm. long.—Moist pine barrens and marshes, North Carolina to Florida, Missouri, Indian Territory, and Texas. March–October.

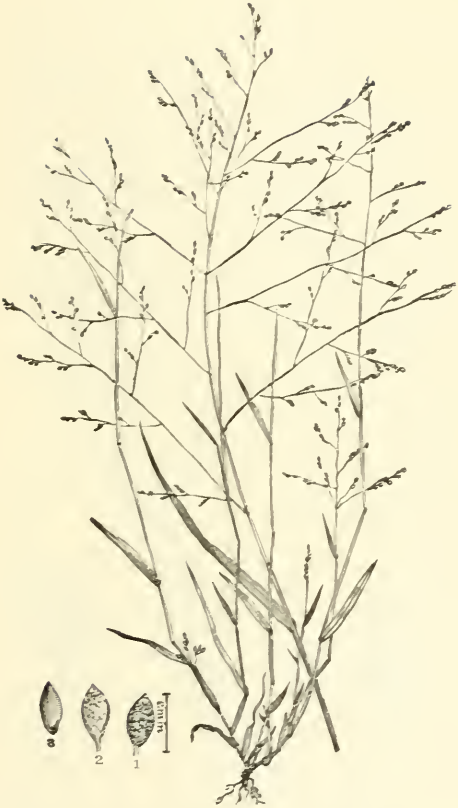


FIG. 49. **Panicum verrucosum** Muhl. WARTY PANIC-GRASS.—A slender, branching perennial, with flat leaves and few-flowered spreading panicles 7.5 to 20 cm. long.—Low, rich woodlands, mostly near the coast, New England to Florida, west to Tennessee and Louisiana May-October.

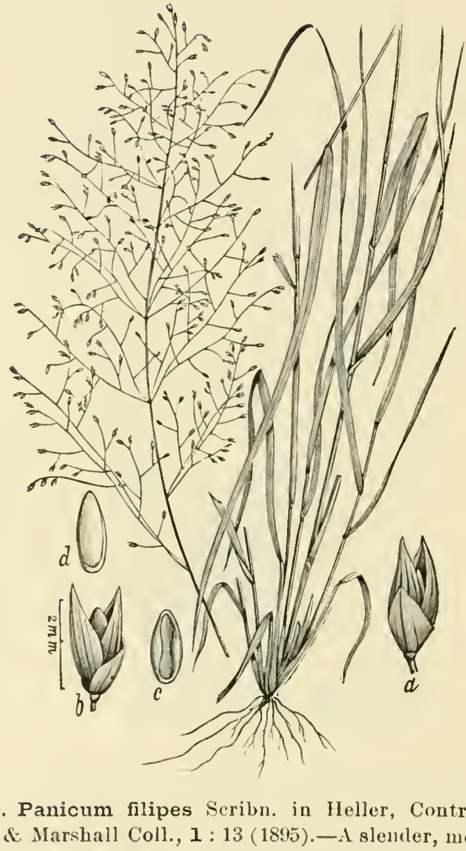


FIG. 50. **Panicum filipes** Scribn. in Heller, Contrib. Herb. Franklin & Marshall Coll., **1** : 13 (1895).—A slender, more or less branching and leafy, glaucous annual (?) 3 to 7 dm. high, with rather long, flat leaves and diffuse capillary panicles 15 to 30 cm. long.—Dry grounds, western Texas and (?) Mexico. May–July.

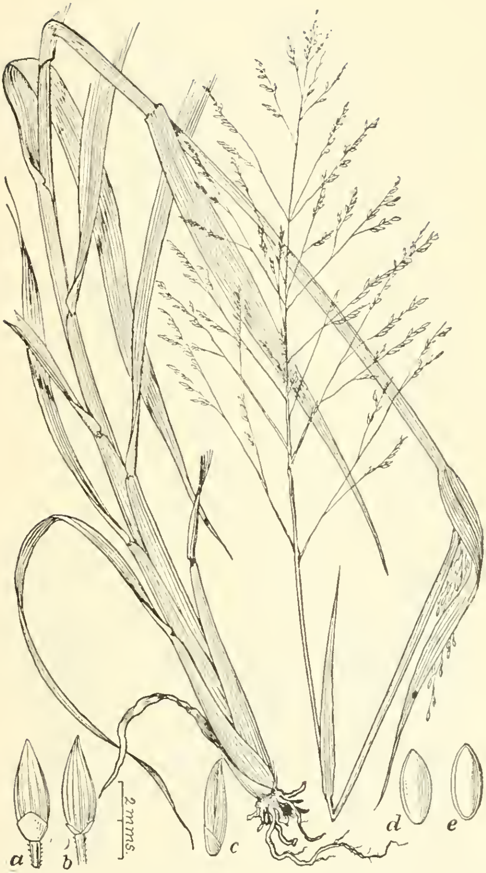


FIG. 51. **Panicum proliferum** Lam. SPROUTING CRAB-GRASS.—A smooth and usually much-branched, native annual, with rather coarse, spreading, or ascending stems 6 to 18 dm. long, flat leaves and diffuse terminal and lateral panicles.—Low ground, ditches, etc., Maine to Illinois and Nebraska, south to Florida and Texas. [Cuba]. March-October.

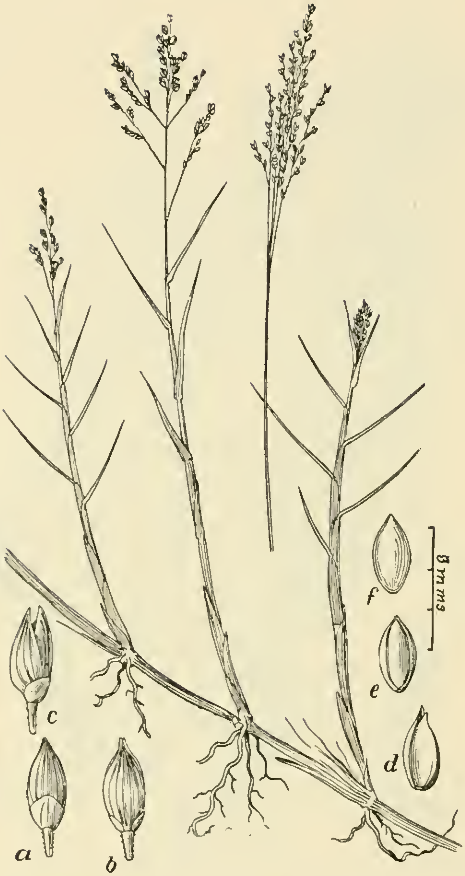


FIG. 52. **Panicum repens** L.; Beal, Grasses N. Am., **2**: 127. CREEPING PANIC.—An extensively creeping, maritime grass, with rather stiff leaves and rigid, upright, flowering stems or branches 2 to 5 dm. high.—Sea beaches, southern Alabama to Louisiana. [Tropical and subtropical coasts of both hemispheres.] A good sand-binder.

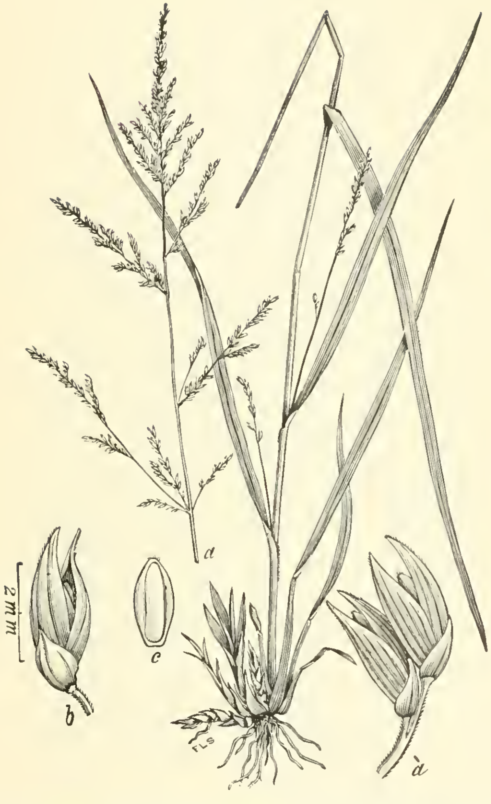


FIG. 53. **Panicum anceps** Michx. FLAT-STEMMED PANIC.—A rather stout perennial, with flattened stems 6 to 12 dm. high, long leaves, smooth or pilose sheaths, spreading panicles and pointed spikelets.—Low woods and thickets, marshes and banks of streams, Pennsylvania to Illinois, Missouri, Indian Territory, Texas, and Florida. July-October.

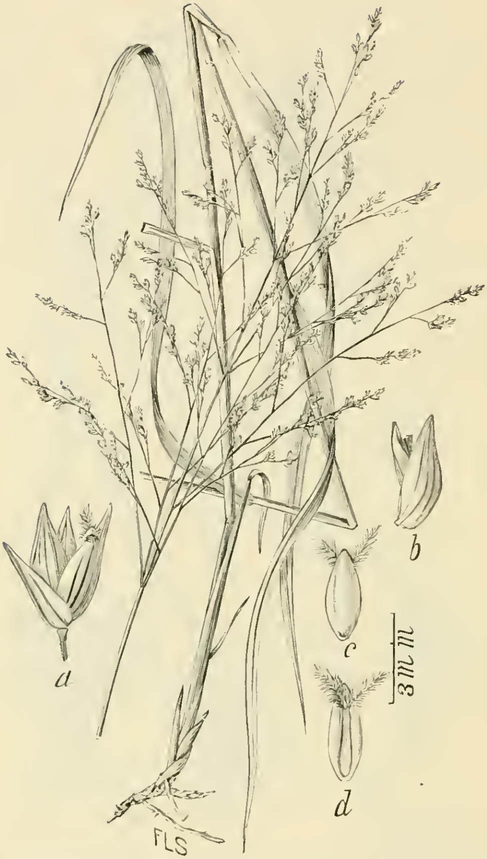


FIG. 54. **Panicum virgatum L.** SWITCH-GRASS.—A stout, erect perennial 9 to 15 dm high, usually forming large tufts, with strong, creeping rootstocks, long, flat leaves, and ample, spreading panicles.—Sandy soil, usually along streams and about ponds and lakes, Maine and Ontario to North Dakota, Colorado, Arizona, Texas, and Florida. [Mexico.] July–October.

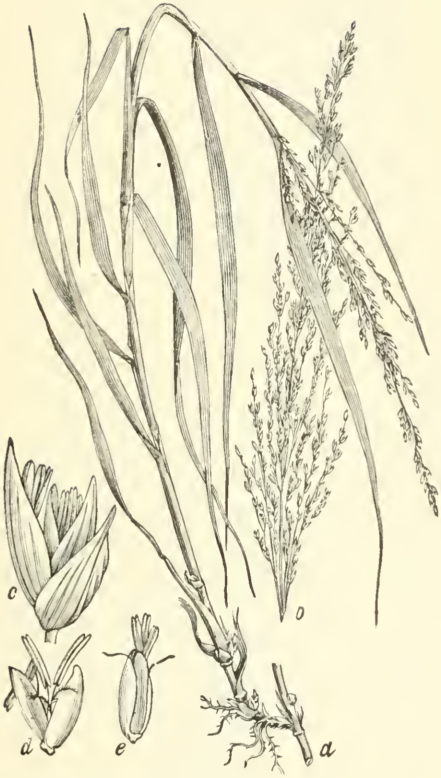


FIG. 55. **Panicum amarum Ell.** BITTER PANIC-GRASS.—A stout, coarse perennial 3 to 12 dm. high, from strong, creeping rootstocks, with rather long (30 to 40 cm.), rigid leaves and many-flowered, open panicles 10 to 30 cm. long.—Sandy beaches, coast of southern New England to southern Florida. July–November. A good sand binder.

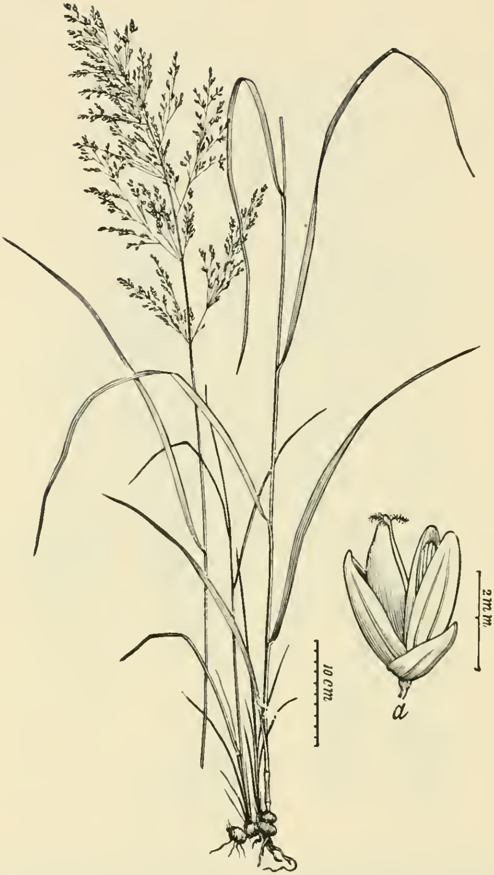


FIG. 56. **Panicum bulbosum** HBK.; Beal, Grasses N. Am., **2**: 131. ALKALI SACCATONE.—A stout, glabrous perennial 9 to 12 dm. high, from a bulbous base, with flat leaves and usually ample panicles 20 to 40 cm. long.—In canyons, Texas to Arizona. [Mexico.] June–September. A valuable hay grass for alkaline soils.

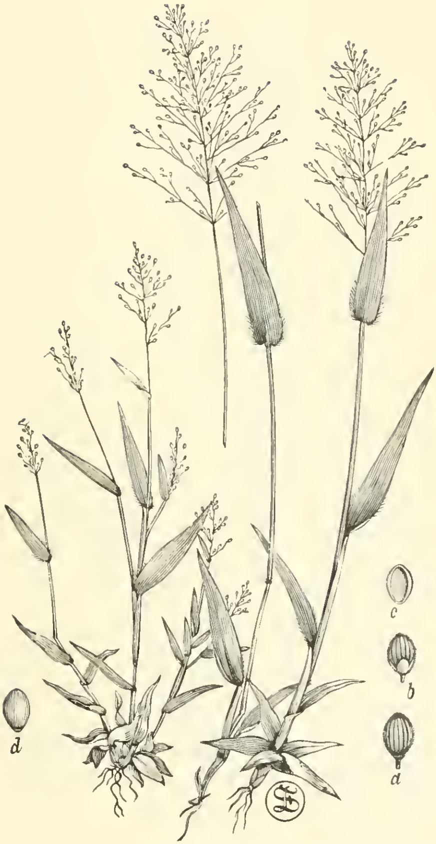


Fig. 57. **Panicum sphærocarpon** Ell.; Britton and Brown, Ill. Fl., **1**: 116. Round-flowered Panic.—A tufted, erect, or ascending perennial 25 to 60 cm. high, with rather broad, firm, and nearly erect leaf blades, diffuse many-flowered panicles and small, rounded spikelets.—Dry or moist woods and fields, Maine to southern Ontario, Wisconsin, Indian Territory, Texas, and Florida. [Mexico and Guatemala.] May–October.

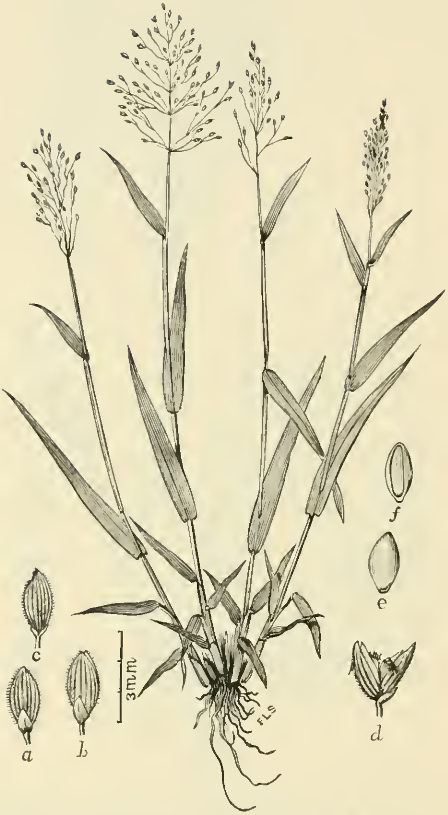


FIG. 58. **Panicum boreale** Nash; Britton and Brown, Ill. Fl., **1**: 119. NORTHERN PANIC-GRASS.—An erect, finally branching perennial 3 to 6 dm. high, with flat leaves and open, spreading panicles 4 to 8 cm. long.—Damp soil, Newfoundland and Ontario to Maine, New York, and Minnesota. June–August.

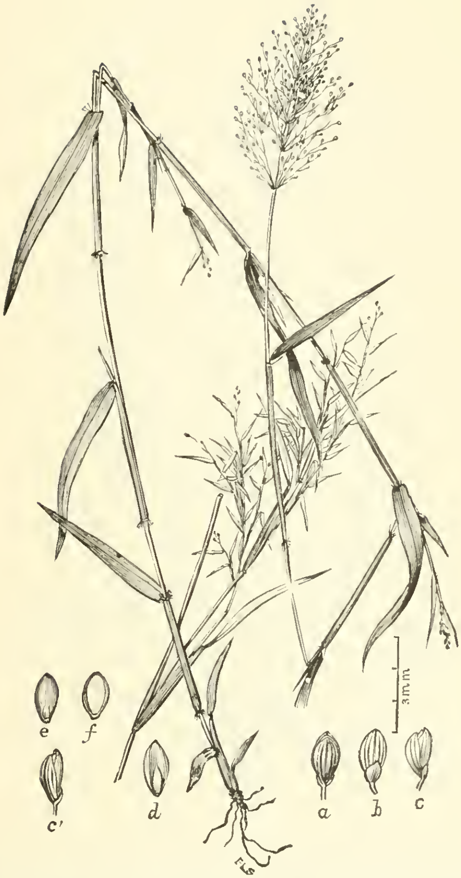


FIG. 59. **Panicum barbulatum** Michx. BEARDED-JOINT.—Culms 3 to 9 dm. high, finally much-branched, slender, smooth, except the nodes, which are conspicuously barbed with reflexed, white hairs, panicle ovate-pyramidal, spikelets numerous, small.—Bogs, wet meadows, and low woodlands, southern New York to Illinois, Florida, and New Mexico.

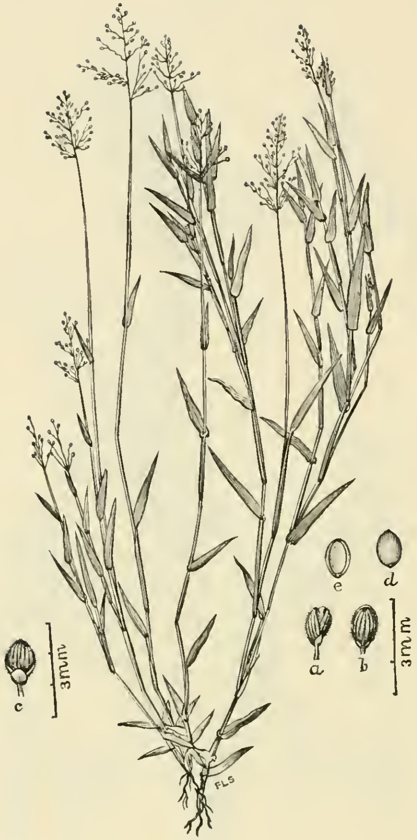


Fig. 60. **Panicum columbianum** Scribn. sp. nov. American Panic-grass.—A slender, erect, much-branched, glabrous perennial, with short (usually 3 to 4 cm. long), lanceolate, ascending, acute leaves, and small-flowered, diffuse, oblong or subpyramidal panicles. Spike-lets about 2 mm. long. Branches finally erect, numerous, flower-bearing.—Dry, sandy fields, meadows, and open woodlands, New England southward to the Carolinas, and westward to Tennessee and Alabama, mostly near the coast; also in California. June–August.

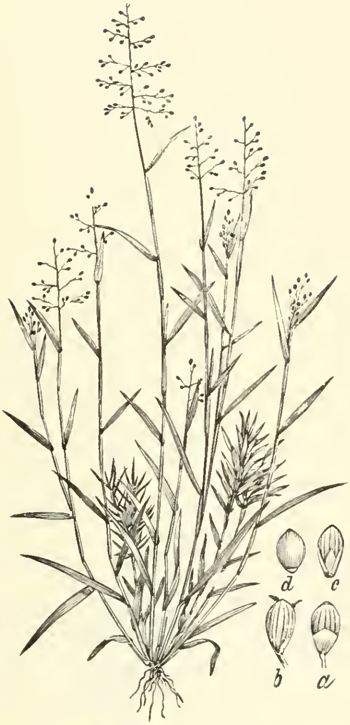


FIG. 61. **Panicum nashianum** Scribn. sp. nov. (allied to *P. demissum* Trin.). NASH'S PANIC-GRASS.—A slender and finally much-branched, leafy perennial 1 to 3.5 dm. high, with flat and rather short leaves, which are ciliate on the margins toward the base, and open pyramidal panicles, the flexuose branches widely spreading or reflexed. (4,029 Curtiss (1893), and 466 Nash (1894).)—Low pine barrens, often in moist ground, near the coast, Virginia to Mississippi. [Brazil.] March–October.

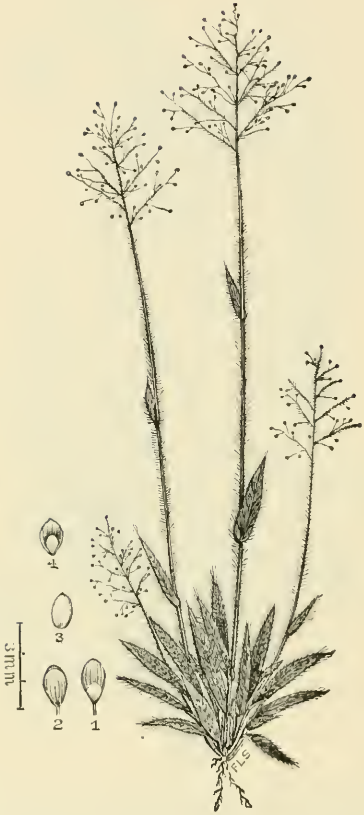


Fig. 62. **Panicum longipedunculatum** Scribn.; Bull. Tenn. Agr. Exp. Station, VII, **1** : 53. Long-stalked Panic.—A slender, cæspitose perennial 1.5 to 3 dm. high, with short, chiefly radical, pilose leaves and diffuse, small-flowered, long-exserted, hairy panicles.—Dry or moist pine barrens and damp woods, apparently rare, eastern Tennessee to eastern North Carolina and Florida. May–August.

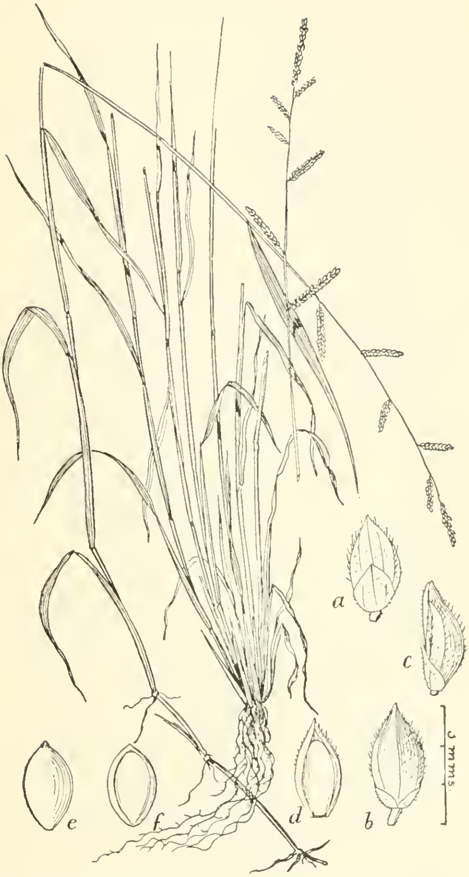


FIG. 63. **Panicum colonum** L. JUNGLE RICE.—An erect or ascending, more or less branching annual 3 to 6 dm. high, with flat leaves and five to ten, densely flowered, one-sided spikes, 1 to 3 cm. long, racemose along the main axis.—Ditches and low ground, Southeastern Virginia and Tennessee to Florida, Texas, and southern California. [Widely distributed in tropical and subtropical regions of the Old World.] June–October.

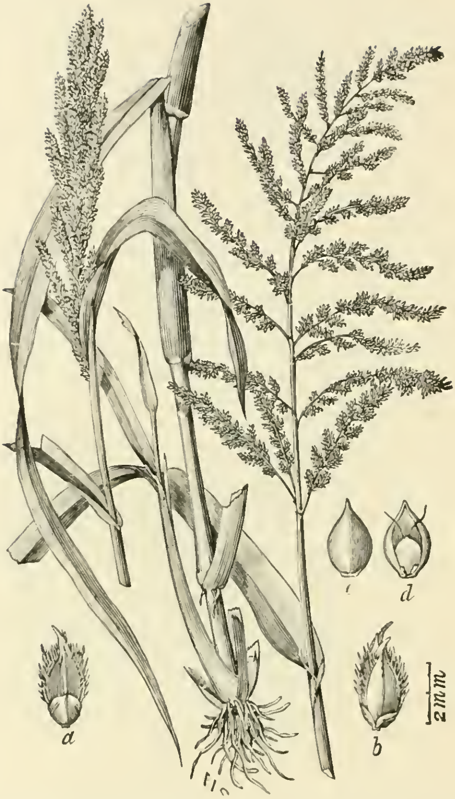


FIG. 64. **Panicum crus-galli L.** BARNYARD-GRASS.—A coarse, ascending or erect, leafy annual 3 to 15 dm. high, with dense panicles and with the third glume awnless to long-awned.—Almost everywhere in the United States in barnyards, waste ground, and river banks. Throughout the warmer regions of both hemispheres. Flowers all summer.

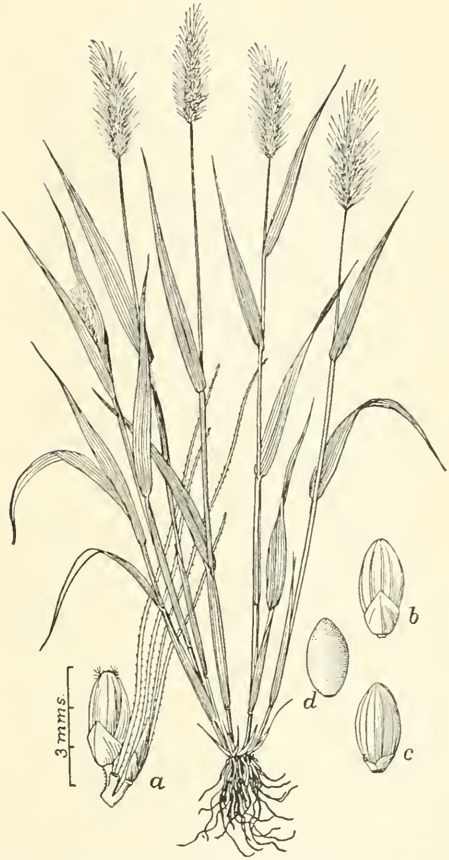


FIG. 65. **Chætochloa viridis** (L.) Scribn. (*Panicum viride* L., *Setaria viridis* Beauv.). GREEN FOXTAIL.—A branching, leafy annual 3 to 6 dm. high, with bristly, densely many-flowered, spike-like panicles 5 to 10 cm. long. Bristles usually green and spikelets smaller than in Yellow Foxtail (*Chætochloa glauca*).—A weed in cultivated and waste grounds; naturalized from Europe. June–October.

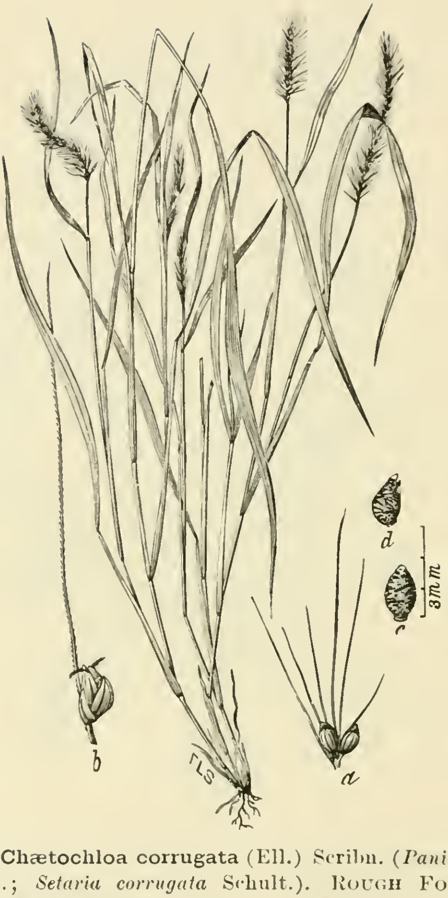


FIG. 66. **Chætochloa corrugata** (Ell.) Scribn. (*Panicum corrugatum* Ell.; *Setaria corrugata* Schult.). ROUGH FOXTAIL.—A rather slender annual 3 to 9 dm. high, usually much branched below, with flat leaves and bristly, spike-like panicles 3 to 10 cm. long.—Usually in cultivated land, Georgia and Florida. May–October.

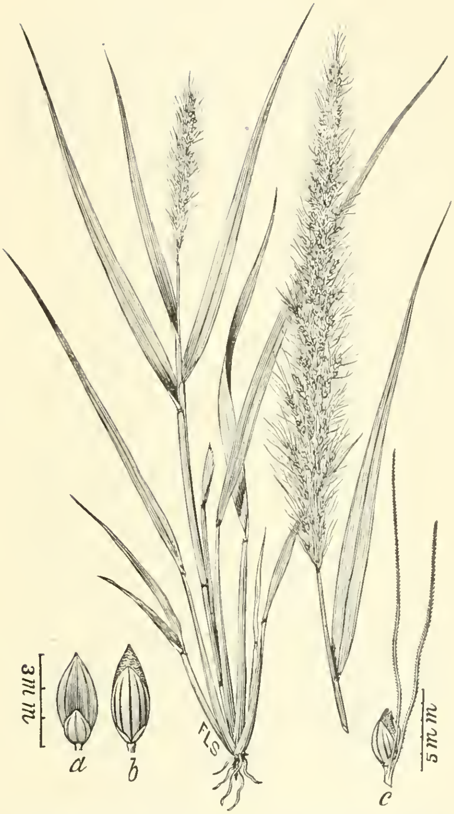


FIG. 67. **Chætochloa composita** Scribn. (*Setaria composita* HBK.?). BRANCHING FOXTAIL.—A stout perennial 6 to 12 dm. high, with broad, flat leaves, and branching, bristly panicles 10 to 25 cm. long. Spikelets 3 mm. long; second glume one-third shorter than the fourth. (No. 3617, A. H. Curtiss.)—Shell islands and keys, sometimes in old pineapple fields, southern Florida. [West Indies.] July–October.

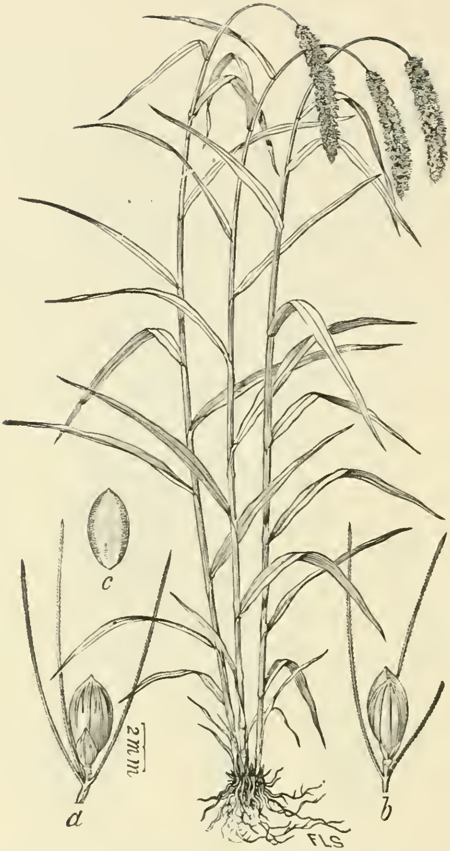


FIG. 68. **Chætochloa italica** (L.) Scribn. (*Setaria italica* Beauv.). ITALIAN MILLET OR HUNGARIAN-GRASS.—A stout and rapidly growing leafy annual 10 to 24 dm. high, with large compound, nodding, bristly, and nearly cylindrical panicles 20 to 40 cm. long —In cultivated and waste land, escaped from cultivation or adventive here and there throughout the country. [Europe, Asia.] July, August.

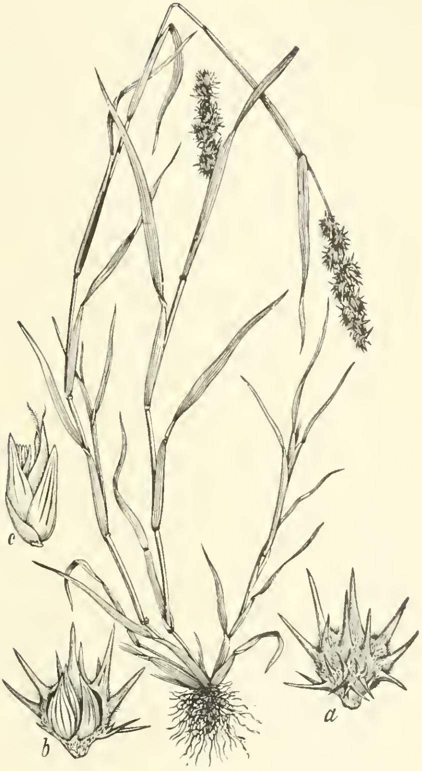


FIG. 69. **Cenchrus tribuloides** L. SAND BUR.—An annual, with spreading or ascending, much-branched, compressed culms usually about 3 dm. high, and terminal racemes, of 6 to 20 bur-like involucres.—Sandy fields, waste ground, river banks, and sea beaches, Maine and Ontario to South Dakota and Colorado, south to Florida and southern California. [Mexico and South America.] June–October.

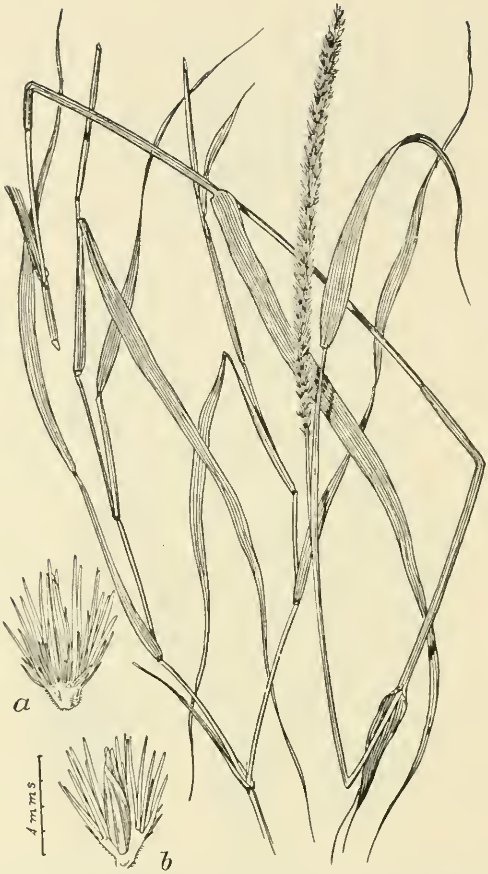


FIG. 70. **Cenchrus myosuroides** HBK.; Beal, Grasses N. Am., **2**: 160. LONG-SPIKED BUR-GRASS.—A stout perennial 6 to 8 dm. high, more or less branching and geniculate below, with flat leaves and long, cylindrical spikes 12 to 20 cm. long.—Waste ground, introduced; southern Florida to Texas. [Mexico, South America.) August-January.

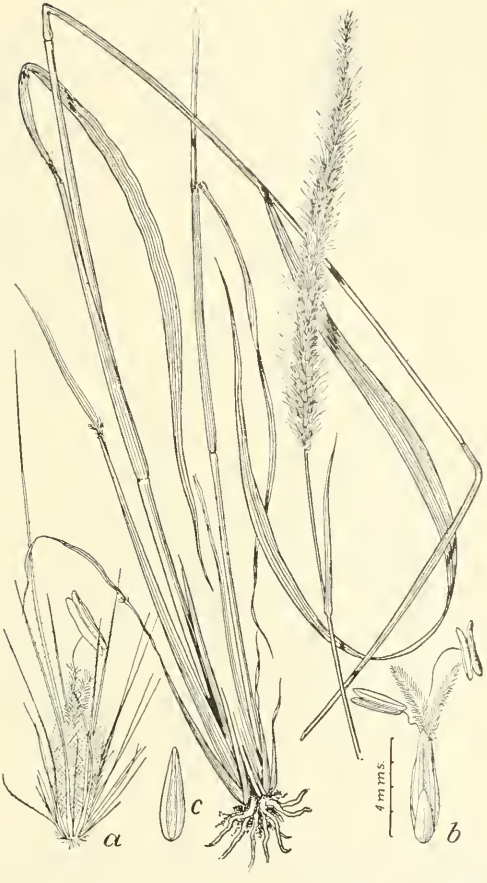


FIG. 71. **Pennisetum setosum** (Sw.) Rich.; Beal, Grasses N. Am., **2**: 166.—A stout, branching perennial 9 to 12 dm. high, with flat leaves and dense, bristly, cylindrical spikes 10 to 15 cm. long.—Southern Florida. [Widely distributed in tropical countries.] September.

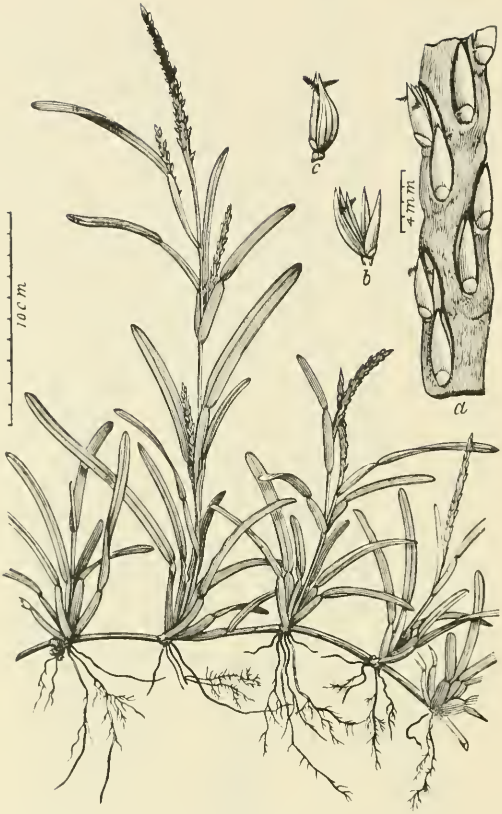


FIG. 72. **Stenotaphrum secundatum** (Walt.) Kuntze (*Ischæmum secundatum* Walt.; *Stenotaphrum americanum* Schrank.). MISSION-GRASS.—Extensively creeping perennial, with hard, flat stems, rather broad leaves, and upright, flowering stems 1.5 to 3 dm. high.—Muddy or moist sandy shores and marshes along the coast, South Carolina to Florida and Louisiana. [Widely distributed in tropical America and the Pacific islands.] April–October.

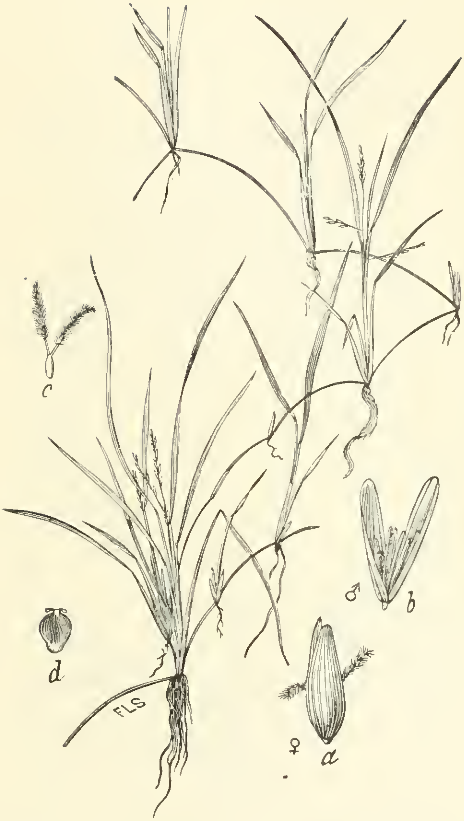


FIG. 73. **Luziola alabamensis** Chapm.; Beal, Grasses N. Am., **2** : 172.—An aquatic, stoloniferous grass, the upright culms 0.5 to 1.5 dm. high, with long, narrow leaves and the staminate and pistillate spikelets in separate panicles.—In springy places and rivulets in the pine barrens, southern Alabama. [Cuba.] June-October.

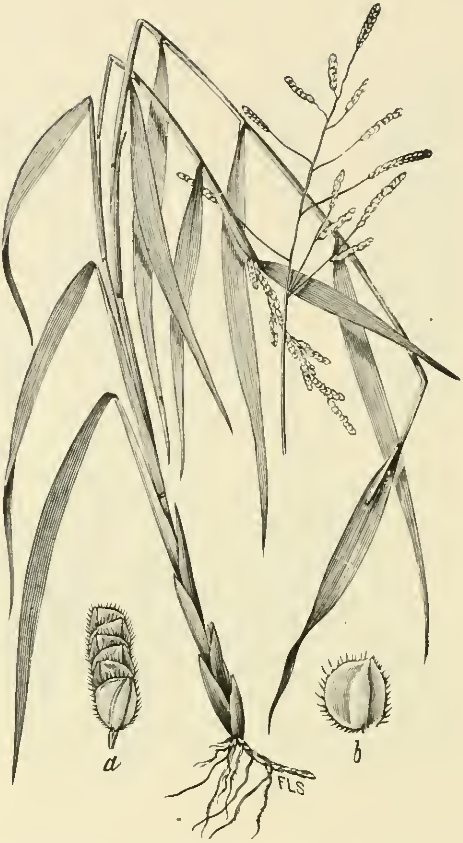


FIG. 74. **Homalocenchrus lenticularis** (Michx.) Scribn. (*Leersia lenticularis* Michx.). CATCH-FLY-GRASS.—A rather stout, branching perennial 6 to 12 dm. high, with widely spreading, broad leaf blades, diffuse panicles, and large, ciliate spikelets.—Marshes and wet thickets, near the coast, Virginia to Texas, and in the Mississippi Valley from southern Illinois and Missouri to Louisiana. August, September.

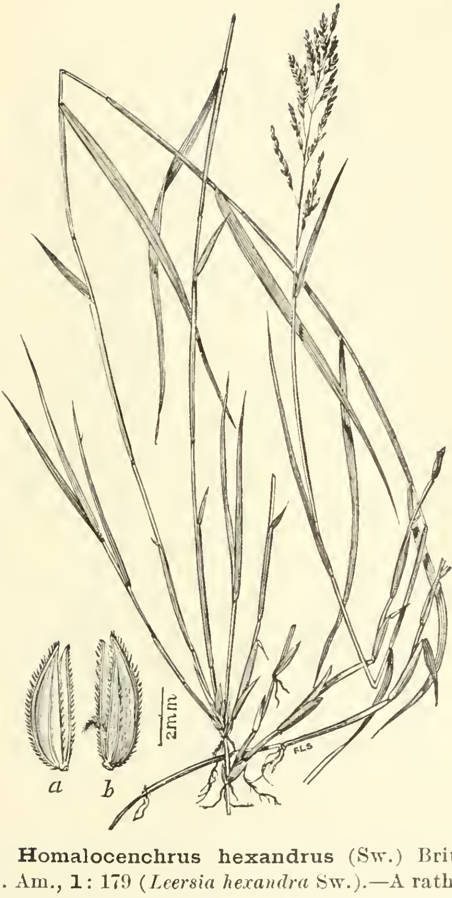


Fig. 75. **Homalocenchrus hexandrus** (Sw.) Britton; Beal Grasses N. Am., **1**: 179 (*Leersia hexandra* Sw.).—A rather slender, usually erect, branching grass 6 to 12 dm. high, with narrow, many-flowered panicles 10 to 15 cm. long.—In swamps and ditches near the coast, North Carolina to Florida and Texas. [In all tropical and many subtropical countries.] May–September.

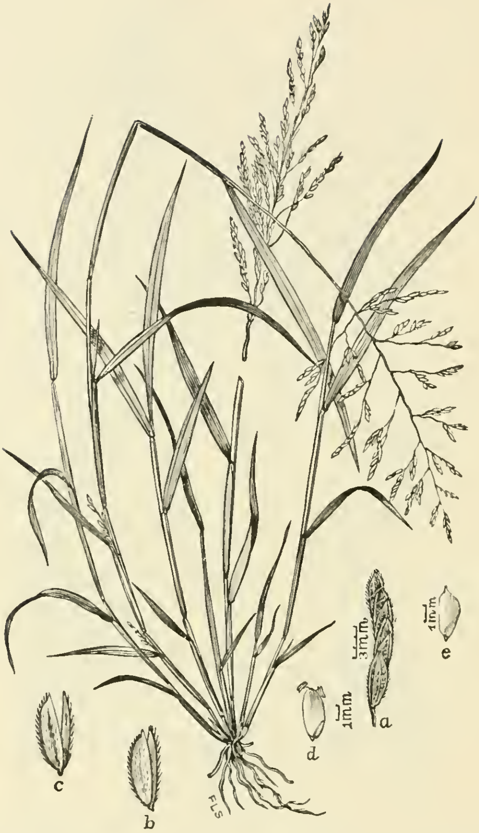


FIG. 76. **Homalocenchrus oryzoides** (Sw.) Poll. (*Leersia oryzoides* Sw.); Britton and Brown, Ill. Fl., **1**: 129. RICE CUT-GRASS.—A rather stout, rough, and much-branched grass 6 to 12 dm. high, with open, pale-green or straw-colored panicles 12 to 25 cm. long.—Along streams and ditches and in marshes, usually in the open, Nova Scotia and Ontario to Washington, Florida, and Texas. [Europe and Asia.] August–October.

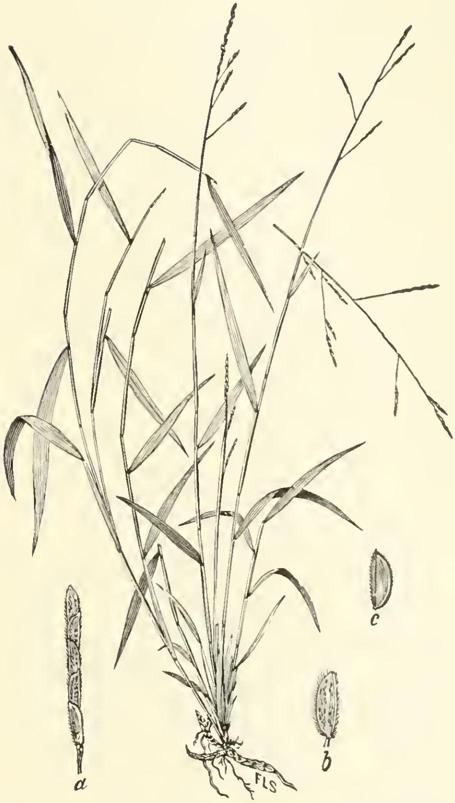


FIG. 77. **Homalocenchrus virginicus** (Willd.) Britton, (*Leersia virginica* Willd.). WHITE-GRASS.—A slender, erect, or ascending, usually much-branched, perennial 6 to 12 dm. high, with narrow leaves and simple panicles 8 to 12 cm. long.—Moist thickets and low woods, usually along streams, Maine and Ontario to South Dakota, southward to Florida, and Texas. May–October.

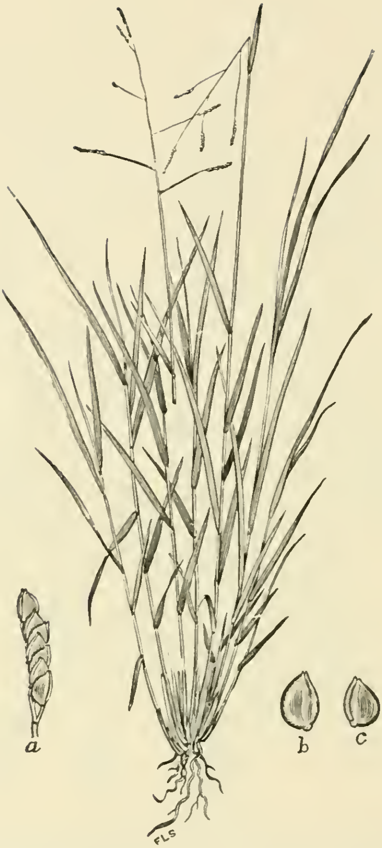


FIG. 78. **Homalocenchrus monandrus** (Sw.) Britton (*Leersia monandra* Sw.); Beal, Grasses N. Am., **2**: 179. SLENDER CUT-GRASS.—A slender, sparingly branched grass with somewhat wiry culms 3 to 6 dm. high, and usually glaucous leaves.—Keys of south Florida (in coral soil) and in southern Texas. [Mexico, West Indies, and South America.] February–May.

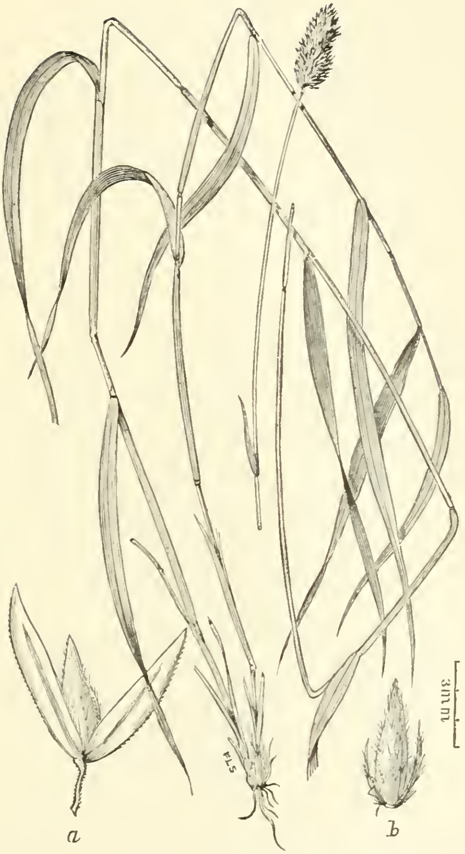


FIG. 79. **Phalaris amethystina** Trin.; Beal. Grasses N. Am., **2**: 183. PURPLE CANARY-GRASS.—A stout annual 4 to 9 dm. high, with broad, flat leaves, and ovoid or oblong, densely-flowered terminal panicles.—Oregon to California and southward to Chile. June.

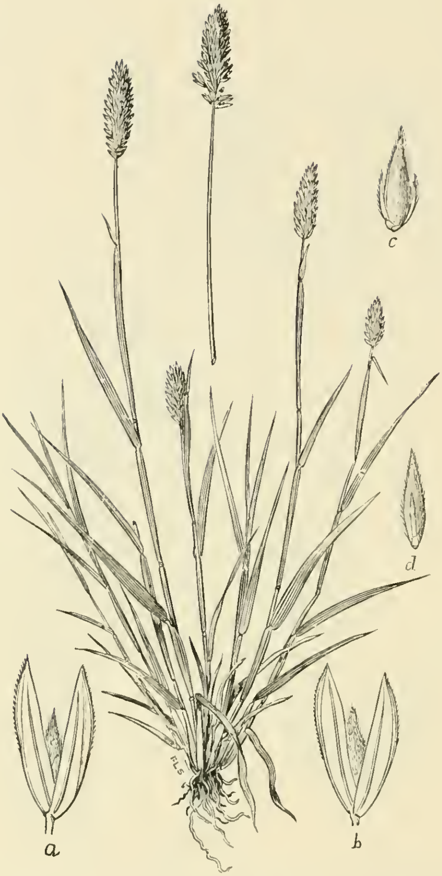


FIG. 80. **Phalaris caroliniana** Walt. (*P. intermedia* Bosc.). SOUTHERN CANARY-GRASS.—A comparatively slender species 3 to 6 dm. high, with rather short, flat leaves, and ovoid, densely flowered, capitate panicles 2 to 5 cm. long.—River bottoms and wet places, South Carolina to Indian Territory, Texas, Nevada, California, and Oregon. April.

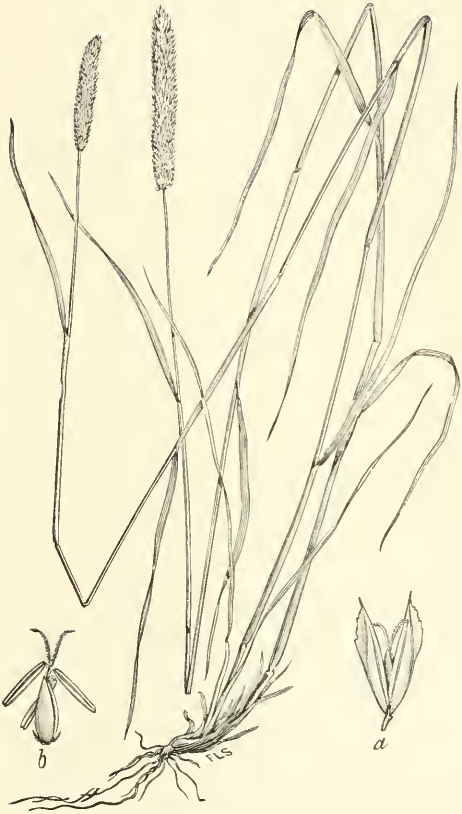


FIG. 81. **Phalaris angusta** Nees (*P. intermedia angusta* Chapm.). CALIFORNIA TIMOTHY.—A stout grass 6 to 14 dm. high, with narrow, densely flowered, spike-like panicles 6 to 12 cm. long.—In wet places, South Carolina and Louisiana to southern California. [South America.] May. Cultivated to a limited extent in the Southern States.

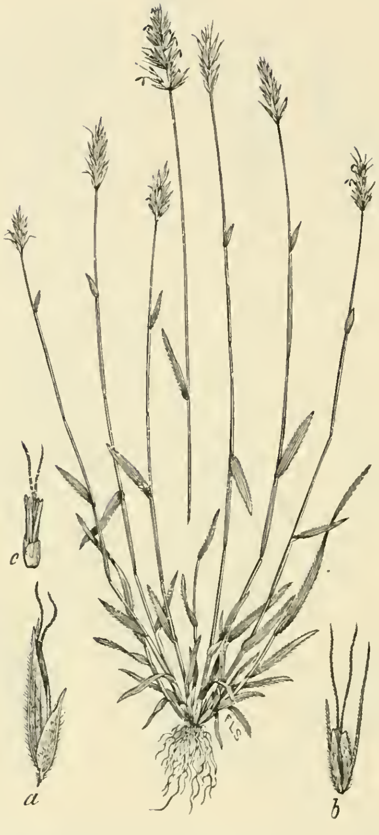


Fig. 82. **Anthoxanthum odoratum** L. Sweet Vernal-grass.—A sweet-scented grass, with slender, erect, tufted culms, flat leaf-blades and narrow, spike-like terminal panicles.—Abundantly naturalized in lawns, fields, and waysides from Newfoundland and Ontario to North Carolina and Tennessee. [Europe, northwestern Asia, and northern Africa.] May–September.

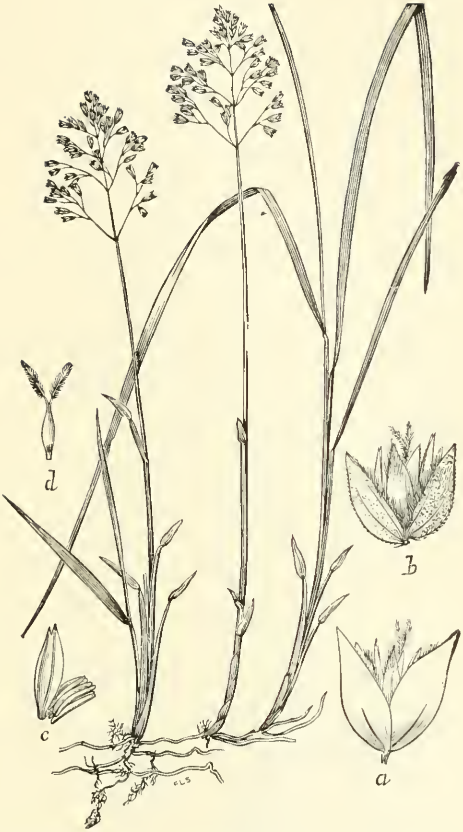


FIG. 83. **Savastana odorata** (L.) Scribn. (*Hierochloë borealis* R. & S.). VANILLA-GRASS.—A slender, sweet-scented, stoloniferous perennial 3 to 6 dm. high, with short culm-leaves and brownish, open panicles. The flat leaves of the sterile shoots are 1 to 3 dm. long.—Newfoundland and New Brunswick to southern New York, west to Minnesota and Iowa; in the Rockies from British America south to Arizona and Mexico; Alaska southward in the mountains to Oregon. [Cooler temperate regions and high mountains of both hemispheres.] April–August.

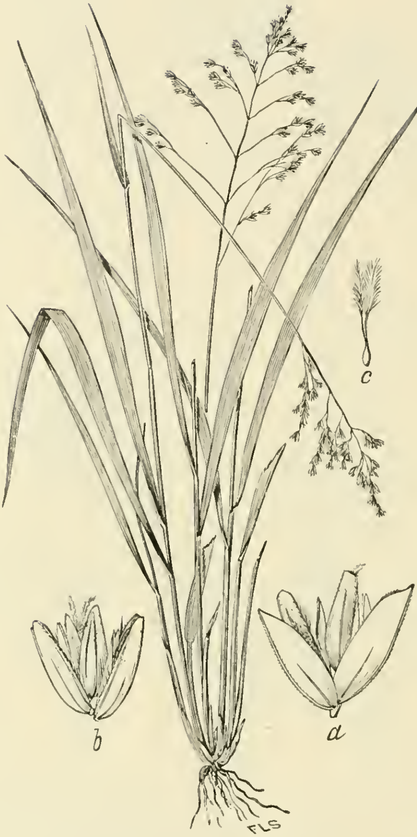


FIG. 81. **Savastana macrophylla** (Thurb.) (*Hierochloë macrophylla* Thurb.); Beal, Grasses N. Am., **2**: 187. LARGE-LEAFED VANILLA-GRASS.—A rather stout, native perennial 6 to 10 dm. high, with long and broad leaves and loosely flowered panicles, usually about 4 inches long.—Coniferous woods, California and Oregon. March–May.

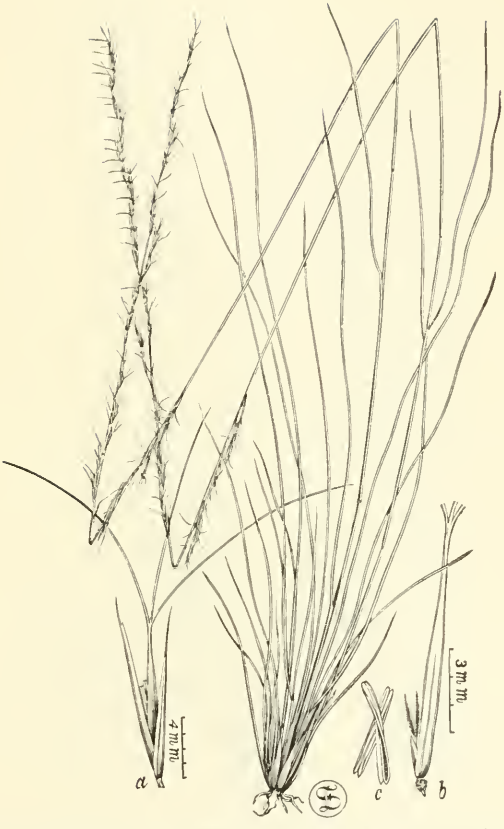


FIG. 85. **Aristida stricta** Michx. WIRE-GRASS.—A rigid, erect wiry perennial 6 to 12 dm. high, with narrow, involute leaves and strict, spike-like panicles about 30 cm. long.—Dry pine barrens near the coast, Virginia (?) and North Carolina to Mississippi, often covering extensive tracts and forming the bulk of the pasturage. July–October.

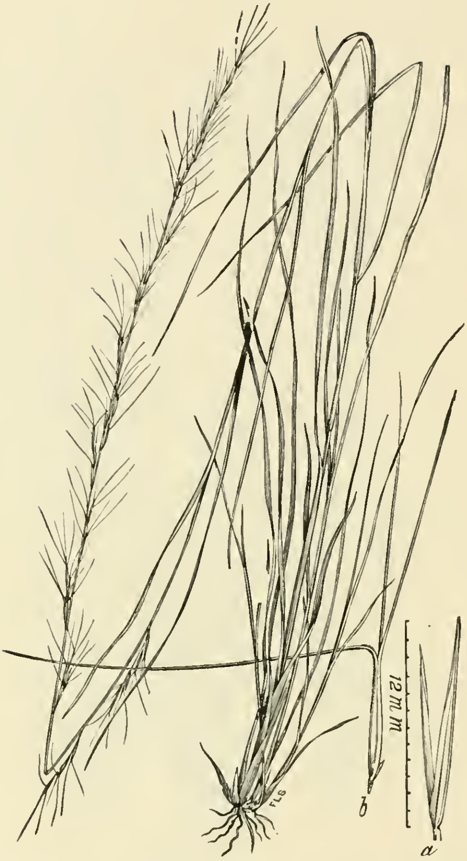


Fig. 86. **Aristida palustris** (Chapm.) Vasey (*A. virgata palustris* Chapm.). Swamp Poverty-grass.—An upright, rigid perennial 6 to 15 dm. high, with long, narrow leaves, and slender, interrupted, spicate panicles 30 to 70 cm. long.—Moist places near the coast in the pine barrens, South Carolina to Texas. [Cuba.] August–October.

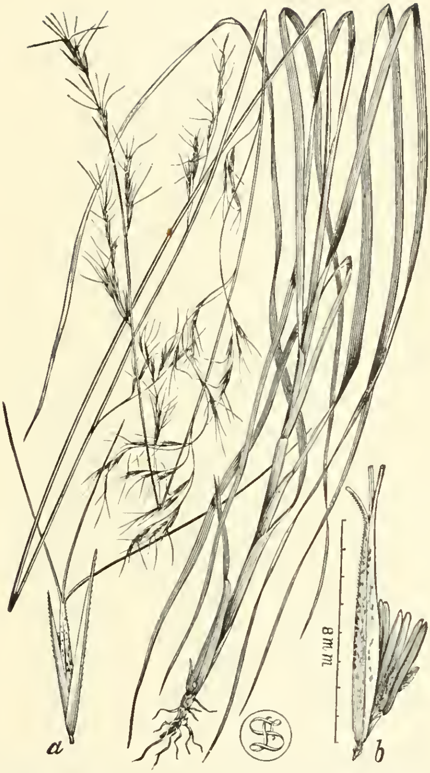


FIG. 87. **Aristida gossypina** Bosc (*A. lanata* Poir.). WOOLLY POVERTY-GRASS.—A rather stout perennial, with simple stems 6 to 12 dm. high, and narrow panicles 30 to 60 cm. long. Lower sheaths usually wooly.—Dry pine barrens, mostly near the coast, Delaware to Texas and Indian Territory. September-November.

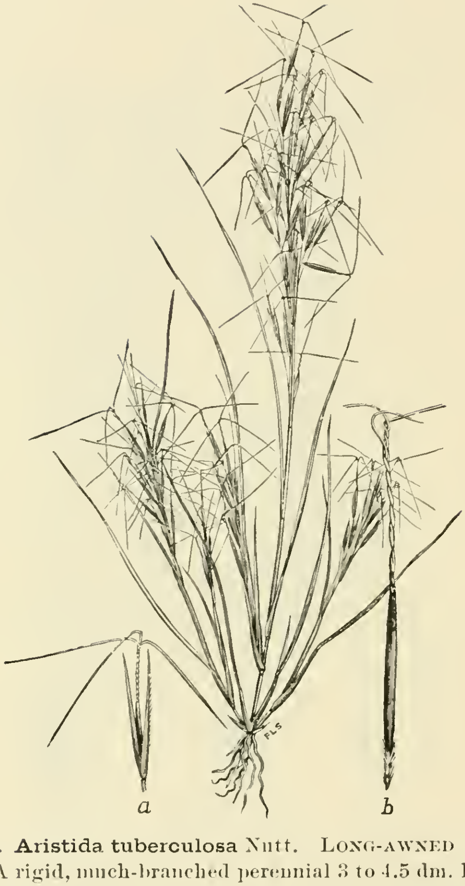


FIG. 88. **Aristida tuberculosa** Nutt. LONG-AWNED POVERTY-GRASS.—A rigid, much-branched perennial 3 to 4.5 dm. high, with nearly simple panicles 10 to 18 cm. long. The widely spreading, nearly equal awns 3 to 4 cm. long.—Dry, sandy soil, near the coast, Massachusetts to Mississippi; also in Illinois, Wisconsin, and Minnesota. August–October.

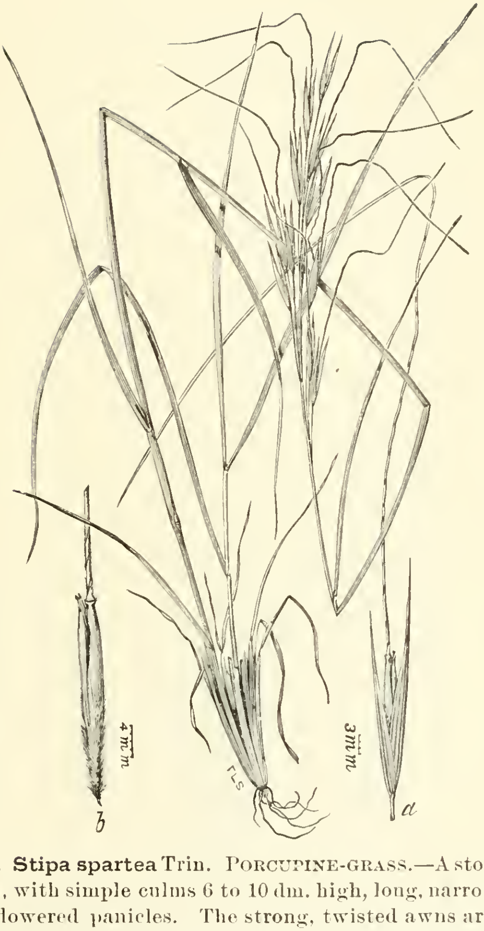


FIG. 89. **Stipa spartea** Trin. PORCUPINE-GRASS.—A stout, erect perennial, with simple culms 6 to 10 dm. high, long, narrow leaves and few-flowered panicles. The strong, twisted awns are 8 to 15 cm. long, and at the base of the flowering glume is a long, pointed, and bearded callus.—Prairies, Illinois to Colorado, north to Manitoba and British Columbia. June–August.

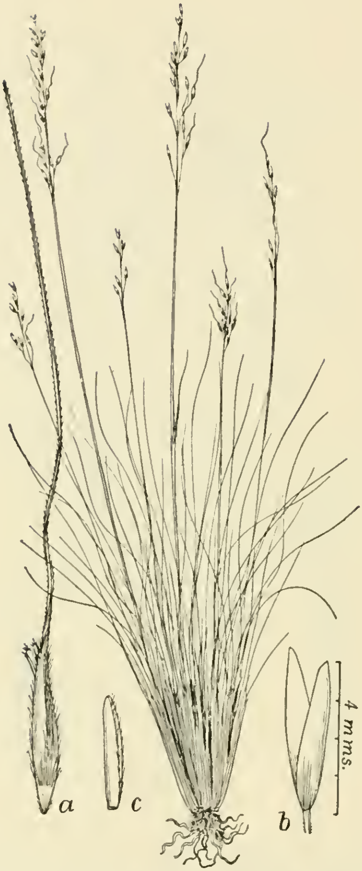


FIG. 90. **Stipa kingii** Boland. (*Oryzopsis kingii* Beal, Grasses N. Am., **2**: 229).—A slender, erect, cæspitose perennial 2 to 4 dm. high, with involute, filiform leaves and contracted panicles 8 to 12 cm. long. Awns scabrous.—California and (?) Nevada.

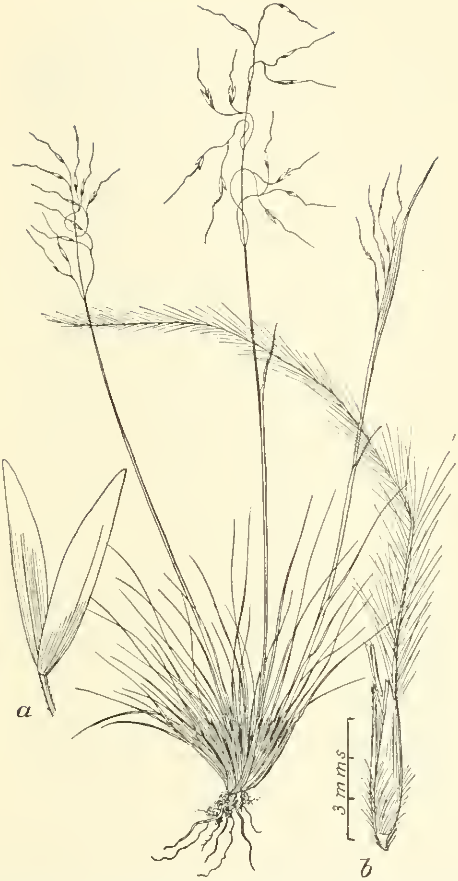


FIG. 91. **Stipa mongolica** Trin.; Beal, Grasses N. Am., **2** : 227 (sub *Oryzopsis*).—A slender, densely tufted perennial about 3 dm. high, with short, setaceous leaves and loosely few-flowered panicles. Awns plumose.—Mountains of Colorado. [Eastern Asia.]

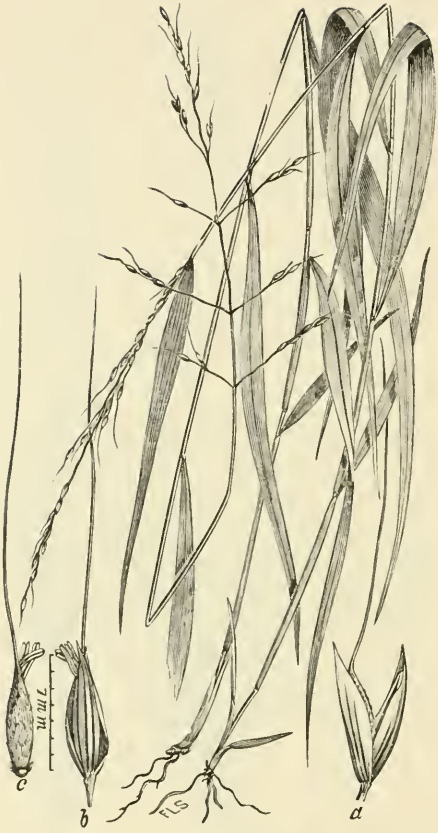


FIG. 92. **Oryzopsis melanocarpa** Muhl. BLACK MOUNTAIN RICE.—A rather stout, long- and broad-leafed perennial 3 to 9 dm. high, with narrow, simple panicles of a few, large spikelets.—Open rocky woods, sometimes on cliffs, Quebec and Ontario to Delaware, Kentucky, Missouri, and Minnesota. July–September.

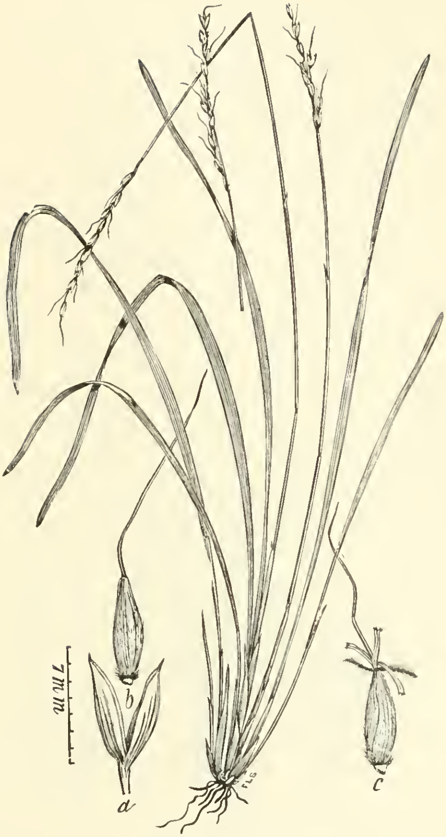


Fig. 93. **Oryzopsis asperifolia** Michx. White Mountain Rice.—A slender perennial 1.5 to 5 dm. high, with narrow, simple panicles 6 to 10 cm. long. The basal leaves, which are 5 to 7 mm. wide, often overtop the culm.—Woods, Newfoundland, Massachusetts and New Jersey, to Minnesota and British Columbia, and southward in the Rockies to New Mexico. April–July.

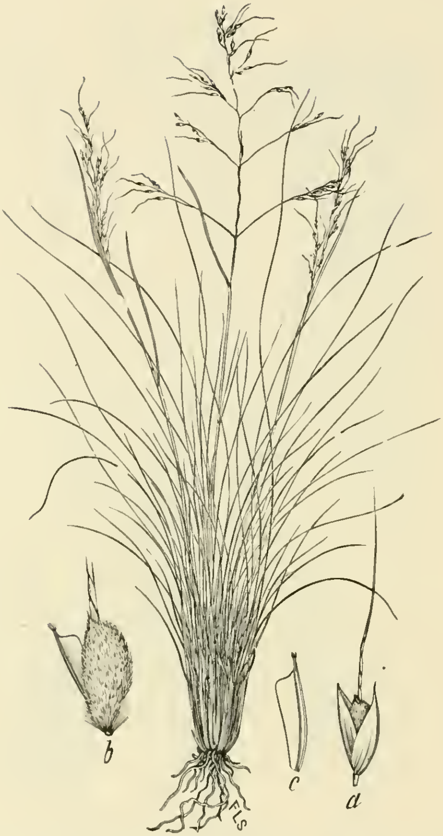


FIG. 94. **Oryzopsis fimbriata** (HBK.) Hemsl.; Beal, Grasses N. Am., **2**: 231.—A slender, tufted perennial 5 to 8 dm. high, with very narrow, involute leaves and loosely flowered panicles 10 to 13 cm. long.—In canyons and under limestone cliffs, mountains of western Texas to California. [Mexico and Lower California.] July–September.

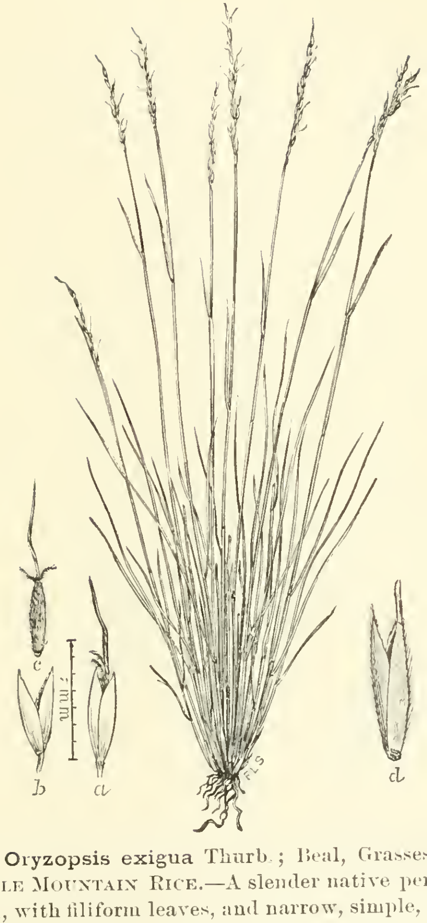


FIG. 95. **Oryzopsis exigua** Thurb.; Beal, Grasses N. Am., **2**: 227. LITTLE MOUNTAIN RICE.—A slender native perennial 1.5 to 3 dm. high, with filiform leaves, and narrow, simple, few-flowered panicles 2 to 5 cm. long.—Among rocks in canyons and on mountain tops, Montana and Wyoming to Utah, Oregon, and Washington. June–August.

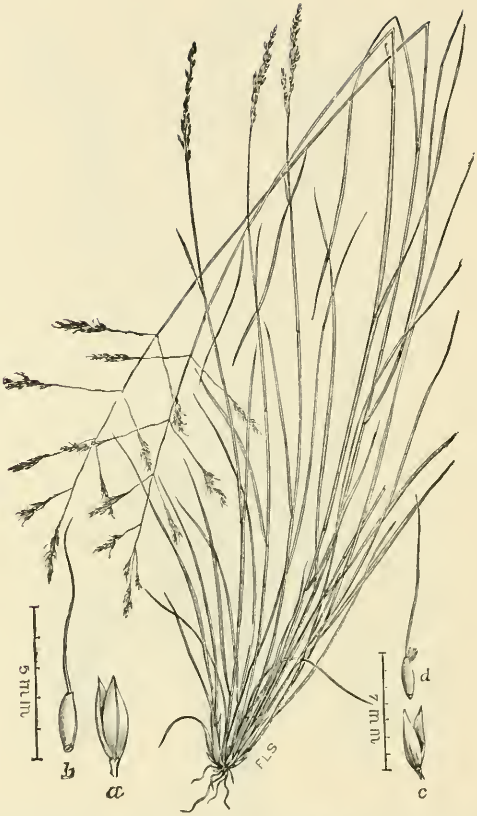


FIG. 96. **Oryzopsis micrantha** (Trin. & Rupr.) Thurb. SMALL-FLOWERED MOUNTAIN RICE.—A slender, erect perennial, usually about 6 dm. high, with narrow leaves and small-flowered, open panicles 8 to 16 cm. long.—Woods, river bluffs, and mountain sides, South Dakota to Nebraska, Colorado, New Mexico, and Arizona. June–August.

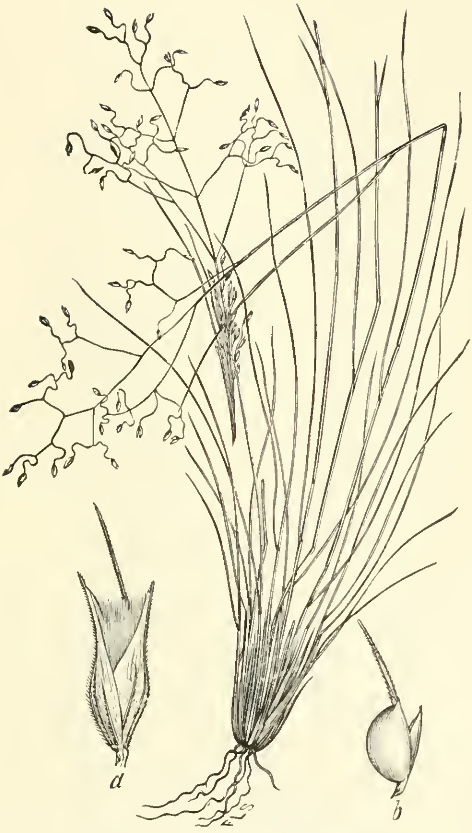


FIG. 97. **Eriocoma cuspidata** Nutt. (*Stipa membranacea* Pursh, not Linn.; *Oryzopsis membranacea* V.). INDIAN MILLET.—A native perennial, growing in bunches 3 to 7 dm. high, with narrow, involute leaves and peculiarly branched, diffuse panicles 12 to 15 cm. long.—Grassy slopes, dry hillsides, sandy river banks, about springs in deserts, in cultivated fields, etc., South Dakota to New Mexico, California, and British Columbia. [Mexico.] May-September.

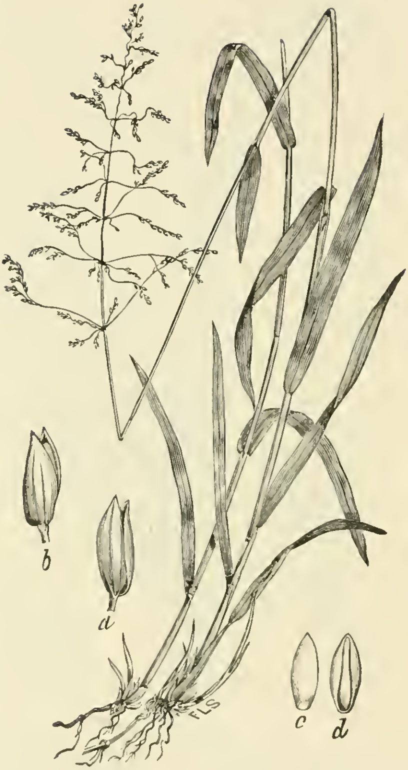


FIG. 98. **Milium effusum L.** WILD MILLET.—A pale-green perennial, with simple culms 6 to 14 dm. high, broad, flat, spreading leaves and diffuse panicles 15 to 18 cm. long.—Woods and ravines, Cape Breton Island to western Ontario, Pennsylvania, Michigan, and Minnesota. [Europe, Asia.] June, July.

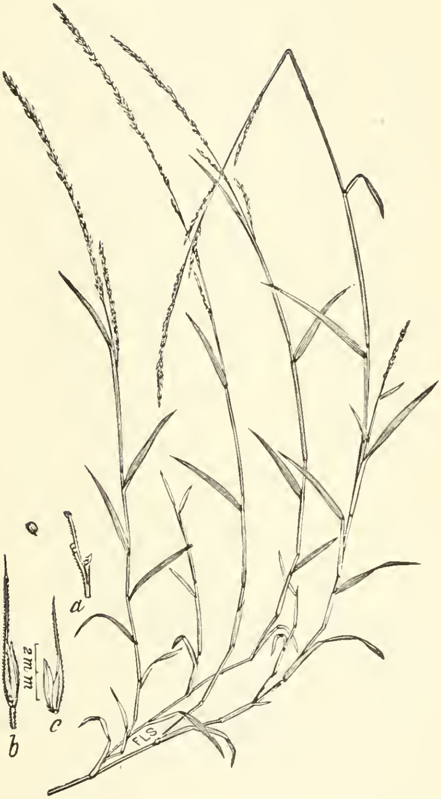


Fig. 99. **Muhlenbergia diffusa** Schreb. Nimble Will.—A low, slender perennial, with ascending, much-branched wiry culms 3 to 6 dm. long, flat leaf-blades and narrow, rather densely flowered panicles.—In shade in thickets, borders of woods, waste ground about dwellings, etc , Maine and Ontario to Minnesota, Kansas, Texas, and Florida. [Mexico (?)] August–January (in Louisiana).

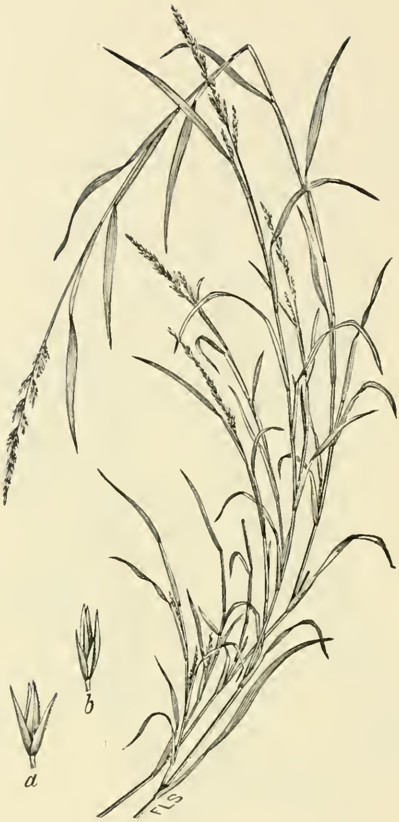


FIG. 100. **Muhlenbergia mexicana** (L.) Trin. MEXICAN DROPSEED.—An upright or ascending, usually much-branched perennial 3 to 9 dm. high, with a scaly, creeping rootstock, numerous, flat leaf blades and contracted, densely flowered panicles.—Sandy or rocky banks of streams and low thickets, New Brunswick and Ontario to North Carolina, Indian Territory, and South Dakota.

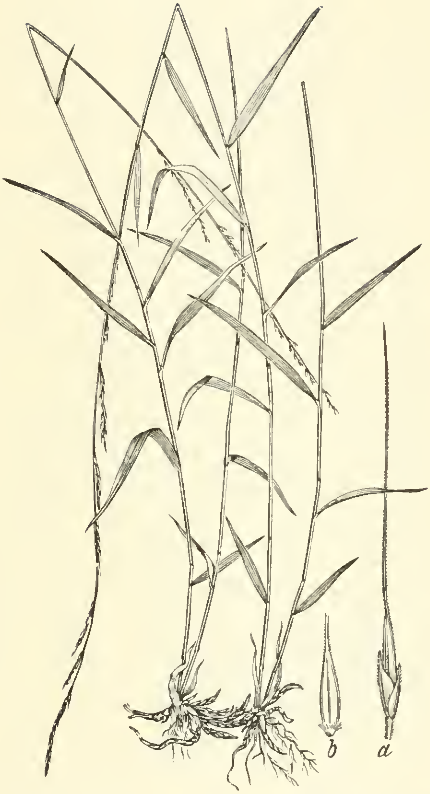


FIG. 101. **Muhlenbergia tenuiflora** (Willd.) B. S. P. (*M. willdenovii* Trin.). SLENDER-FLOWERED DROPSEED.—An erect, simple or sparingly branched perennial 3 to 9 dm. high, with creeping, scaly rootstocks, flat leaf blades and rather few-flowered, linear panicles.—Rocky woods, Massachusetts to Ontario, Minnesota, Texas, Alabama, and Virginia. August, September.

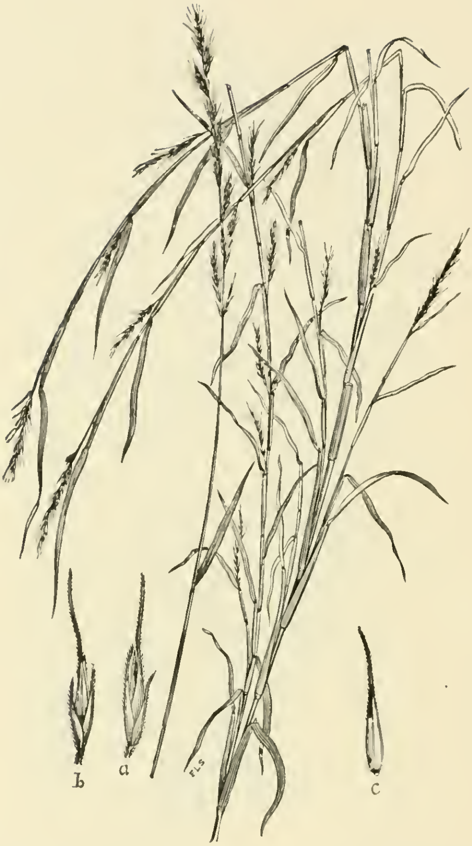


FIG. 102. **Muhlenbergia sylvatica** Torr. WOODLAND DROPSEED.—A perennial, usually much-branched grass 6 to 9 dm. high, with strong, scaly rootstocks, flat leaves and narrow, densely flowered panicles 5 to 15 cm. long.—In rocky woods, and wooded banks of streams, New Brunswick and Ontario to North Carolina, Tennessee, Texas, Kansas, and Minnesota. August–October.

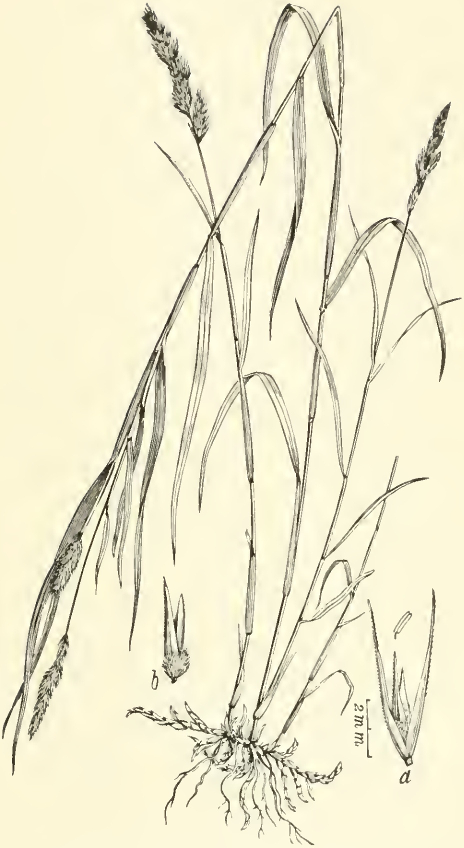


Fig. 103. **Muhlenbergia racemosa** (Michx.) B. S. P.; Britton and Brown Ill. Fl., **1** : 143 (*M. glomerata* Trin.). Wild Timothy.—A rather stout, upright perennial, with very tough and densely scaly rootstocks, nearly simple culms 6 to 9 dm. high, and densely flowered, narrow panicles 5 to 10 cm. long.—Moist meadows and low grounds, Newfoundland to New Jersey, Missouri, Arizona, and British Columbia. June–September.

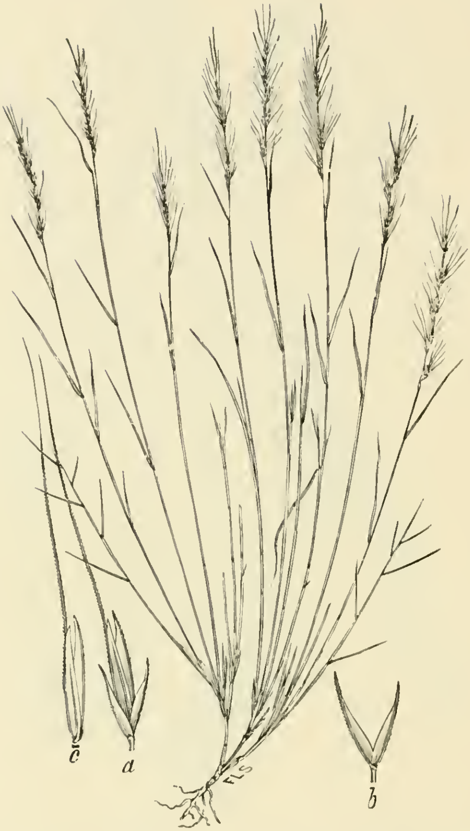


FIG. 104. **Muhlenbergia pringlei** Scribn.; Beal, Grasses N. Am., **2**: 257.—An erect, densely cæspitose, wiry perennial, with simple culms 3 to 4 dm. high, involute-filiform leaves and slender, contracted, often purplish panicles 6 to 10 cm. long.—Canyons, basins, and shaded ledges, mountains of New Mexico and Arizona. [Mexico.] May-September

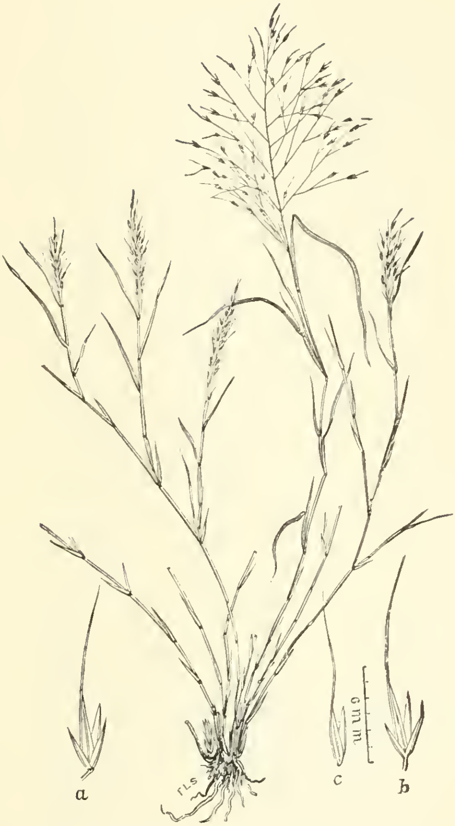


FIG. 105. **Muhlenbergia porteri** Scribn. in Beal, Grasses N. Am., **2** : 259 (*M. texana* Thurb. not Buckley).—A much-branched native perennial, with slender, somewhat wiry stems 3 to 6 dm. long, rather short, narrow leaves, and diffuse panicles. Valuable for grazing and for hay.—Dry mesas and table-lands, Texas to Arizona, Nevada, and California. [Mexico.] August, September.

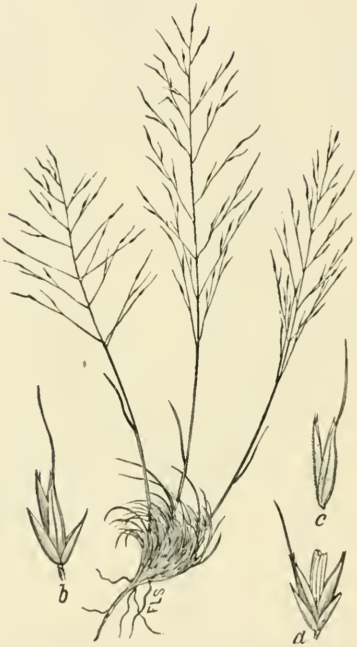


FIG. 106. **Muhlenbergia gracillima** Torr.; Beal, Grasses N. Am., **2**: 261.—A densely tufted perennial, with slender culms 2 to 4 dm. high, numerous involute basal leaves and open capillary panicles 10 to 15 cm. long.—Dry plains, Kansas to Colorado, Texas, and Arizona. July–October.

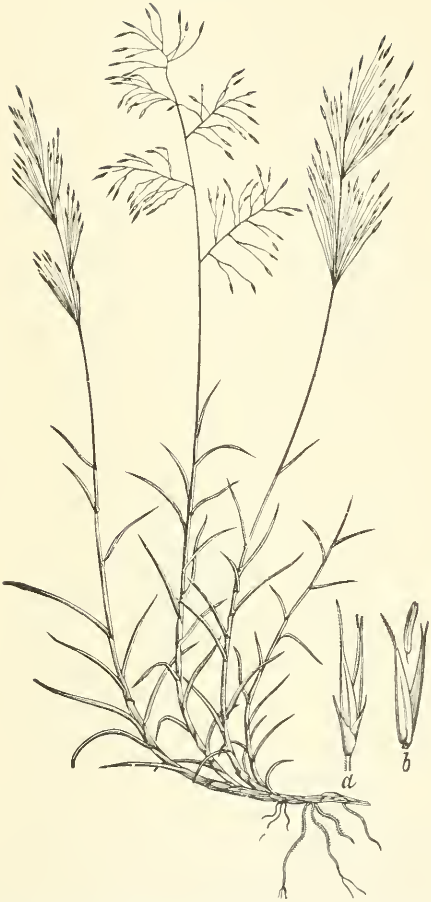


FIG. 107. **Muhlenbergia pungens** Thurb.; Britton and Brown, Ill. Fl., **1**: 146.—A rigid, native perennial 3 to 4.5 dm. high, with firm, sharp-pointed leaves and open panicles about 15 cm. long.—Dry soil, sand hills and plains, Nebraska to Utah, Texas and Arizona. July–October.

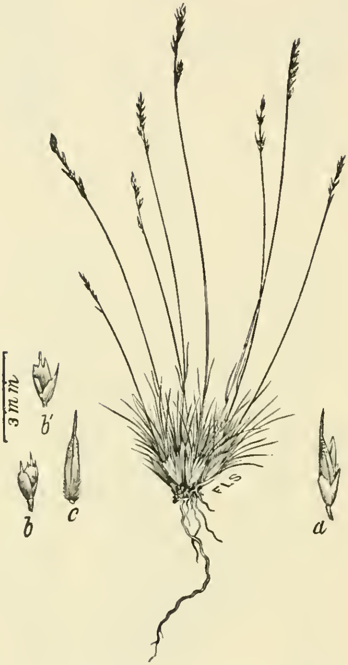


Fig. 108. **Muhlenbergia filiculmis** Vasey; Contrib. U. S. Nat. Herb. **1** : 267; Beal, Grasses N. Am., **2** : 250. THREAD-LIKE MUHLENBERGIA.—A low, tufted perennial with filiform scape-like culms 1.5 to 3.5 dm. high, setaceous radical leaves and narrow, spike-like panicles 2 to 5 cm. long.—Sandy soil, Ute Pass, El Paso County, in moist prairies at Como, Park County, and on the mesas at Twin Lakes, Lake County, Colorado; alt. 2,000 to 3,000 m. July-September.

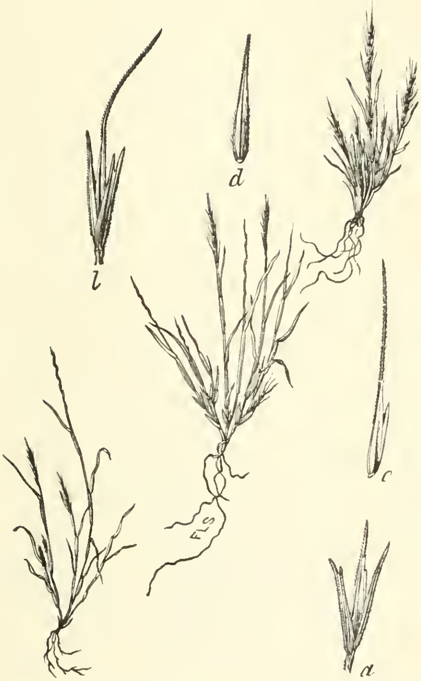


FIG. 109. **Muhlenbergia schaffneri** Fourn; Beal, Grasses N. Am., **2**: 239.—A low, cæspitose, branching annual 2 to 10 cm. high, with short leaves and simple, spike-like panicles. Awn of the flowering glume 1 to 7 lines long.—"Dry, gravelly patches of thin soil," mountains of Arizona and New Mexico. [Mexico.] September.

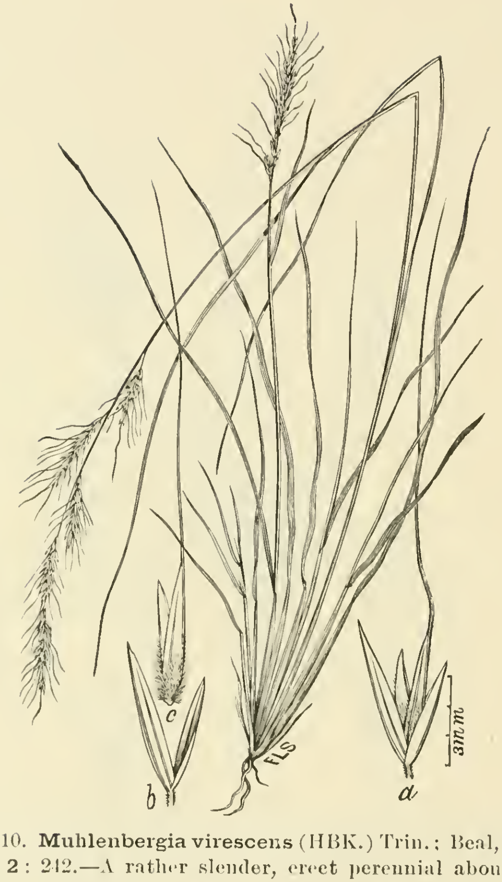


FIG. 110. **Muhlenbergia virescens** (HBK.) Trin.; Beal, Grasses N. Am., **2**: 242.—A rather slender, erect perennial about 6 dm. high, with long, narrow leaves and a strict, pale-green or straw-colored panicle about 15 cm. long.—At an altitude of 1,800 to 2,400 m. on the mountains of Arizona and New Mexico. [Mexico.] May, June.

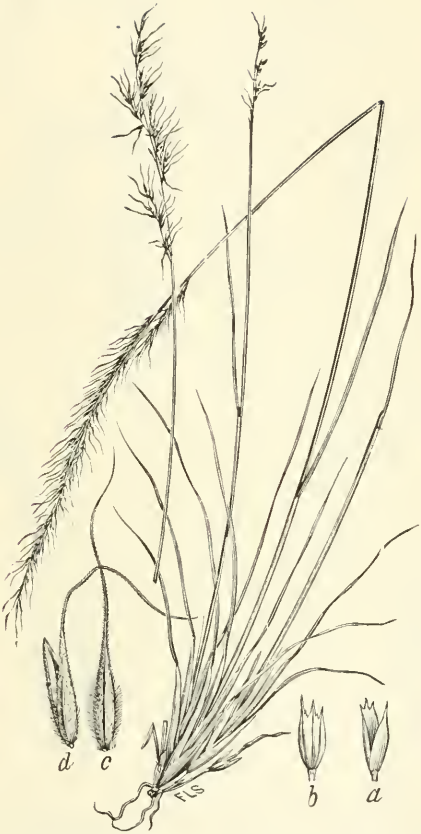


FIG. 111. **Muhlenbergia gracilis** Trin.; Beal, Grasses N. Am., **2**: 242.—A slender, but rather rigid, densely cæspitose perennial 1.5 to 6 dm. high, with narrow, involute leaves, and contracted panicles 8 to 15 cm. long.—Ascending to 2,700 m. or more. Texas to Arizona, Colorado, and Wyoming. [Mexico.] June–September.

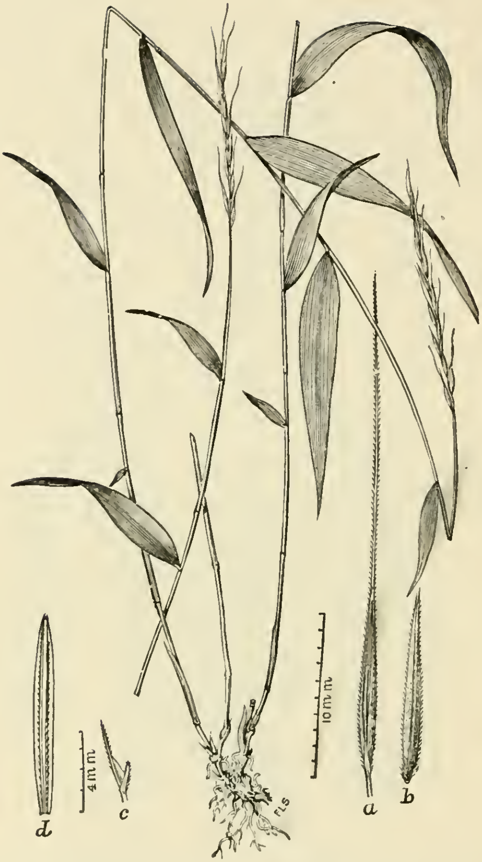


FIG. 112. **Brachyelytrum erectum** (Schreb.) Beauv. (*B. aristatum* R. & S.). Bearded Short-husk.—A perennial, with simple culms 3 to 9 dm. high, flat, spreading leaf blades and few-flowered, simple, terminal panicles.—Open, rocky woods, Newfoundland to North Carolina, Alabama, Missouri, and Minnesota and Ontario. May–August.

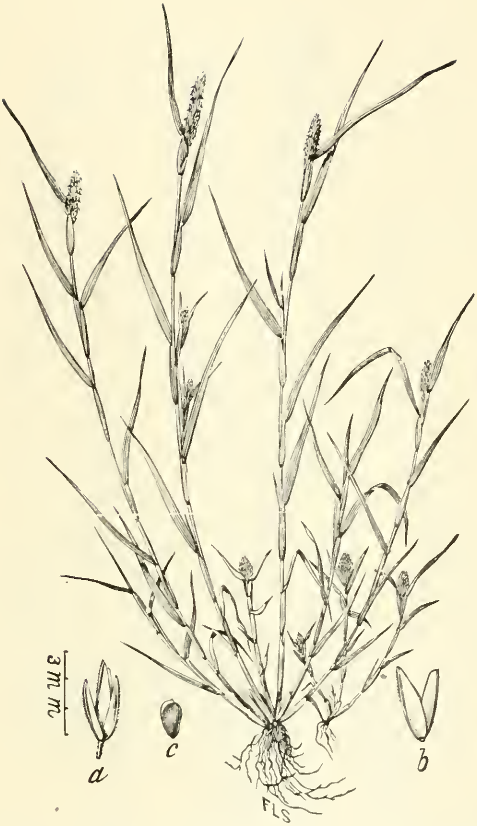


Fig. 113. **Heleochloa schœnoides** (L.) Host (*Phleum schœnoides* L.; *Crypsis schœnoides* Lam.). Rush-like Timothy.—A diffusely branching cæspitose annual 1 to 3 dm. high, with inflated sheaths, rather short, spreading leaves, and densely flowered ovate, or oblong, spike-like panicles.—Waste ground about New York City, Philadelphia, etc., sparingly naturalized. [Europe and Asia.] July, August.

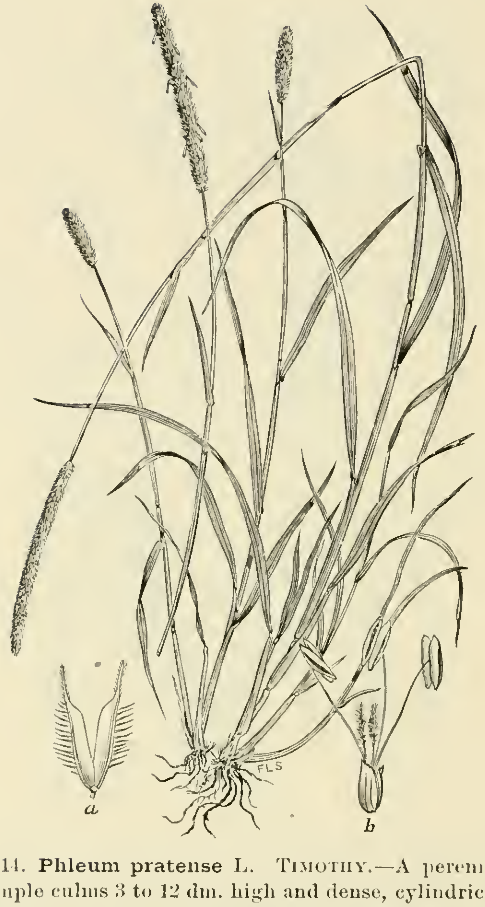


FIG. 114. **Phleum pratense** L. TIMOTHY.—A perennial with erect, simple culms 3 to 12 dm. high and dense, cylindrical, spike-like panicles 2.5 to 10 cm. long.—Widely cultivated and completely naturalized in fields, waysides, and waste ground throughout the United States and British America. [Europe and Asia.] June-August.

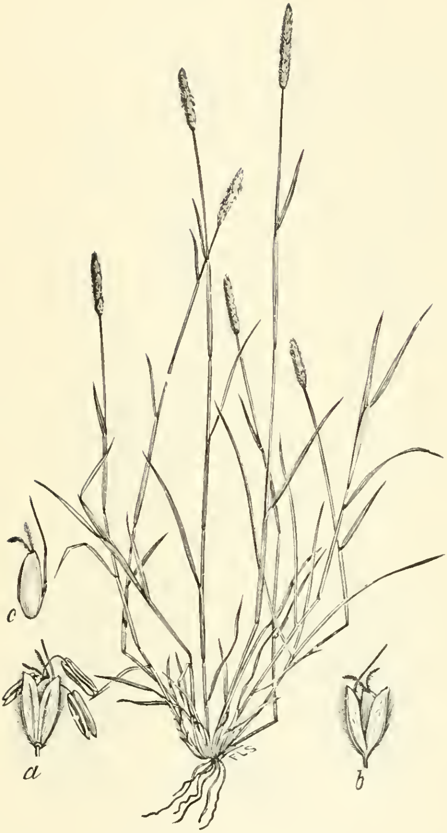


FIG. 115. **Alopecurus geniculatus** L. FLOATING FOXTAIL.—A slender perennial, with culms decumbent and branched at base, then erect or ascending, 1.5 to 6 dm. high, flat, spreading leaves and dense, spike-like, slender panicles 2.5 to 7.5 cm. long.—Wet meadows, banks of streams and ditches throughout the United States, and from Newfoundland to British Columbia. [Europe and Asia.] April–September.

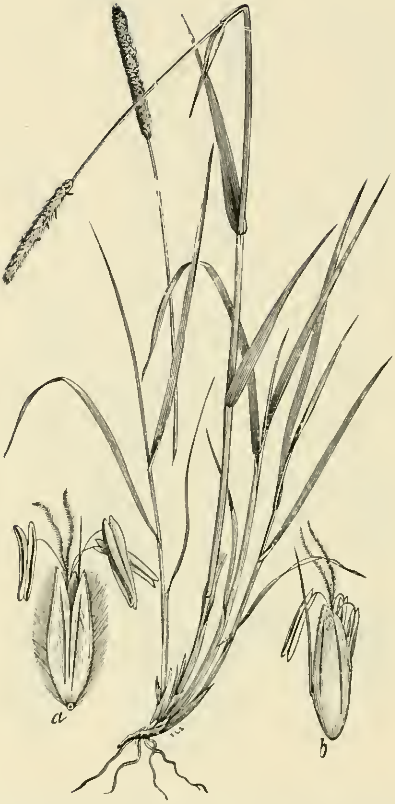


FIG. 116. **Alopecurus pratensis** L. MEADOW FOXTAIL.—An erect, smooth perennial 3 to 9 dm. high, with short, creeping rootstocks, flat, spreading leaf blades, and dense, cylindrical, spike-like panicles 5 to 10 cm. long.—Naturalized in fields and meadows, Labrador to southern New York, Ohio and Michigan; also Oregon, Idaho, and California. [Europe, Asia, and Africa.] June, July.

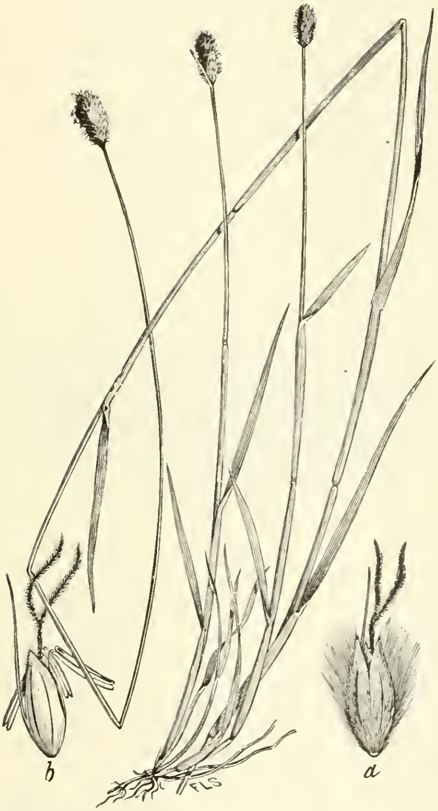


FIG. 117. **Alopecurus occidentalis** Scribn. (*A. pratensis alpestris* A. Gray). MOUNTAIN FOXTAIL.—An erect, rather slender grass 6 to 9 dm. high, with shorter and thicker heads than those of Meadow Foxtail.—Wet meadows and banks of streams, high mountains of Montana, Idaho, Wyoming, and Colorado. June–September. A valuable hay grass.

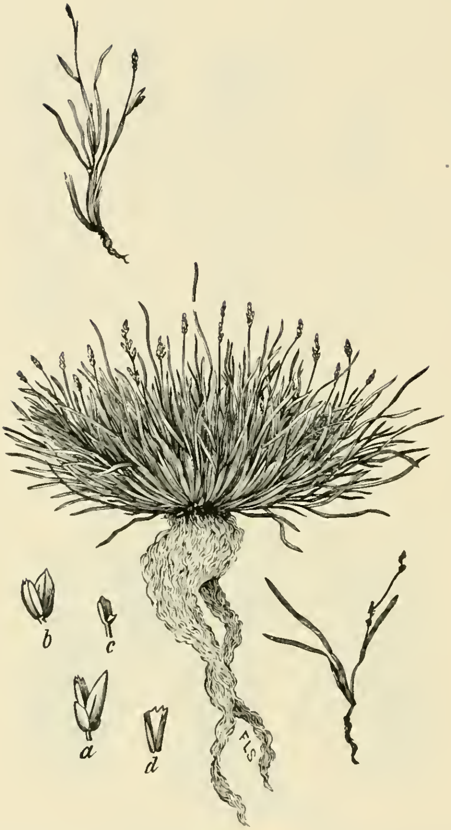


FIG. 118. **Phippsia algida** (Soland.) R. Br.; Britton and Brown, Ill. Fl., **1**: 150. PHIPPSIA.—A low, tufted, glabrous perennial 2 to 10 cm. high, with narrow, soft, and flat leaves and contracted, simple panicles.—Arctic North America and on the highest mountain peaks of Colorado. [Greenland, arctic Europe, and Asia.] July, August.

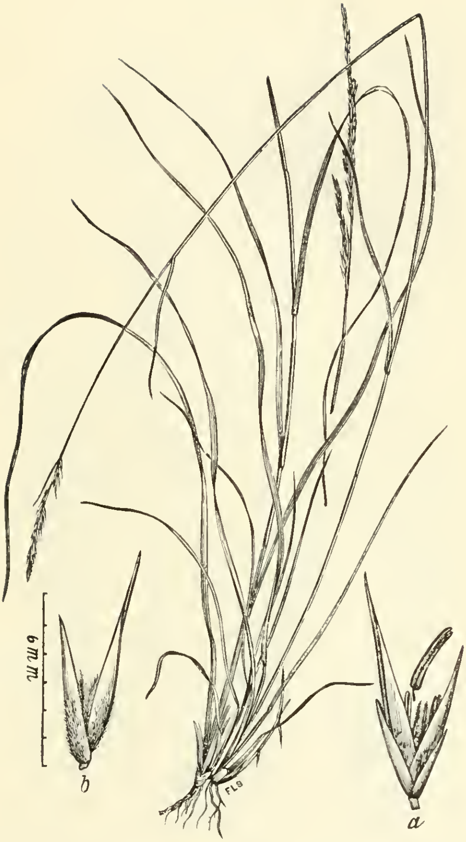


FIG. 119. **Sporobolus asper** (Michx.) Kunth (*Agrostis asper* Michx.). PRAIRIE-GRASS.—A rather slender perennial 3 to 9 dm. high, with usually long, involute-filiform leaf blades and contracted, linear panicles 5 to 15 cm. long.—In dry, sandy soil, open woods and glades, Long Island to Florida, west to Texas, Missouri, and Illinois. August-October. Avoided by stock excepting when young.

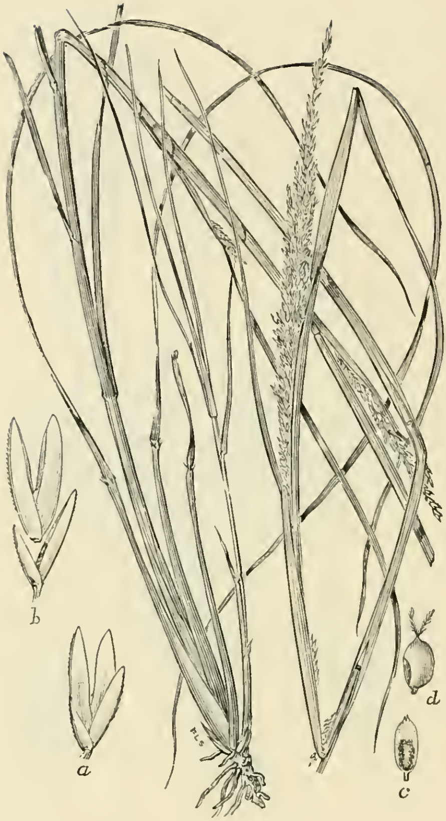


Fig. 120. **Sporobolus longifolius** (Torr.) Wood; Britton and Brown, Ill. Fl., **1**: 151. Long-leafed Sporobolus.—A stout perennial 3.5 to 10 dm. high, with very long, attenuate-pointed leaves, and strict, spike-like panicles 3 to 10 inches long, which are more or less included in the inflated leaf sheaths.—Dry, sandy soil, Maine to Pennsylvania, South Dakota and Utah, south to Texas and Florida. August–October.

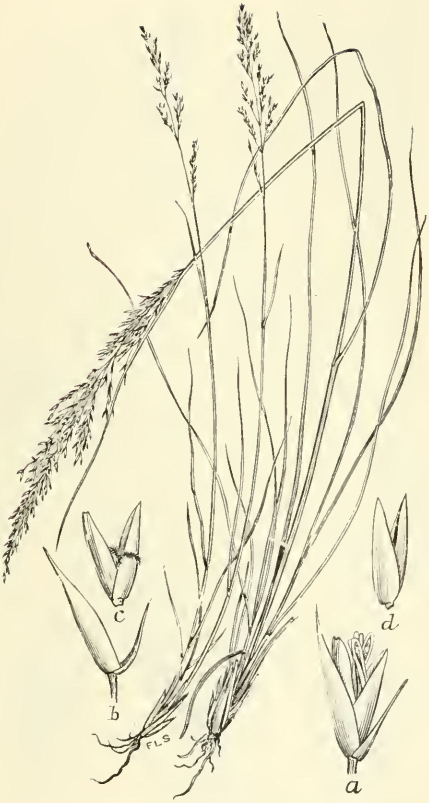


FIG. 121. **Sporobolus heterolepis** A. Gray. STRONG-SCENTED SPOROBOLUS.—A rather stout, somewhat wiry, cæspitose perennial 6 to 9 dm. high, with very long basal leaves and loose, open panicles.—In dry soil, prairies, etc., Connecticut to Quebec, Iowa and Nebraska and Wyoming, thence south to Texas and north to Assiniboia and Saskatchewan. August, September.

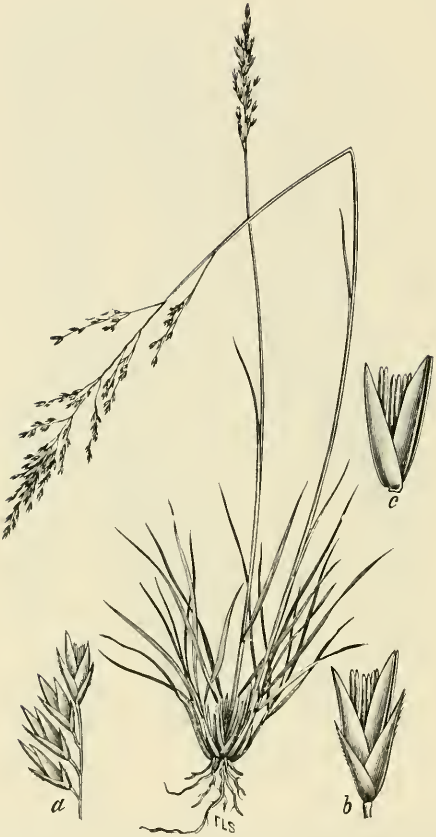


FIG. 122. **Sporobolus interruptus** Vasey; Beal, Grasses N. Am., **2** : 286.—A rather stout, erect perennial with simple culms about 4 dm. high, flat leaves and narrow but loosely flowered panicles 10 to 18 cm. long.—In forests, mountains of Arizona. August, September.

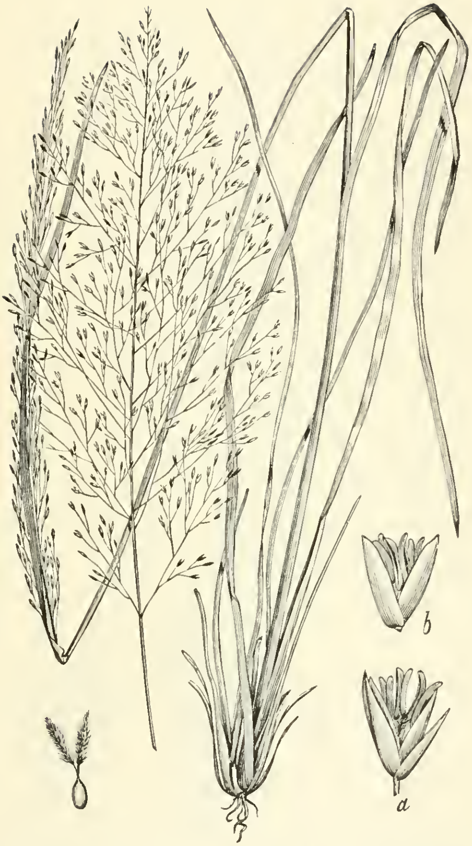


FIG. 123. **Sporobolus floridanus** Chapm.—A rather stout, erect perennial 6 to 12 dm. high, with long, narrow leaves and diffuse panicles 2.5 to 5 cm. long. Pedicels capillary; spikelets purplish.—Moist pine barrens near the coast, North Carolina to western Florida. July–September.

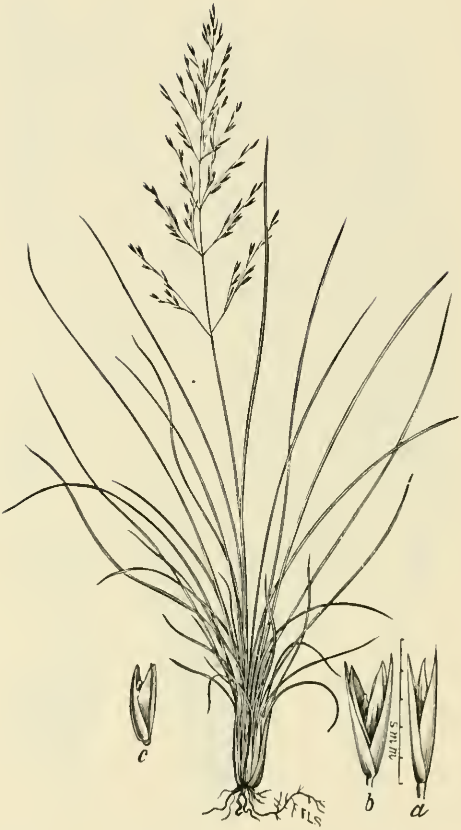


FIG. 124. **Sporobolus curtissii** (Vasey) Small. (*S. floridanus curtissii* Vasey; Beal, Grasses N. Am., **2** : 290).—A wiry, erect perennial 3 to 6 dm. high, with very long leaves and loosely flowered, open panicles 15 to 25 cm. long.—Moist pine barrens, northeastern Florida. July–November.

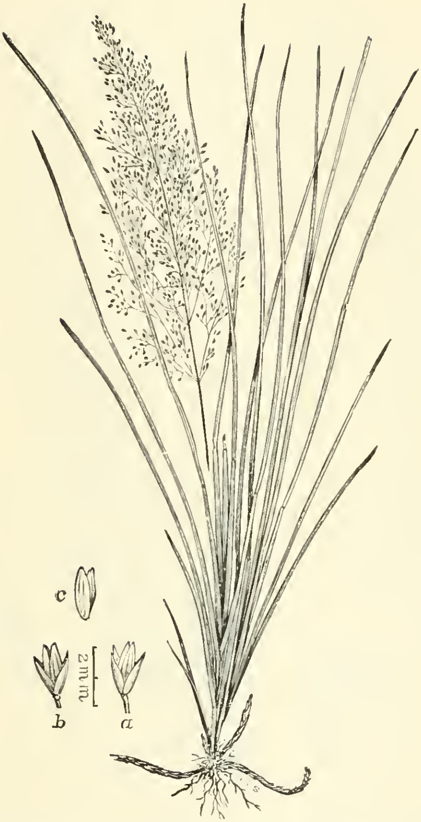


FIG. 125. **Sporobolus compressus** (Torr.) Kunth. (*Agrostis compressa* Torr.). FLAT-STEMMED SPOROBOLUS.—A cæspitose perennial, with short, scaly rootstocks, flattened culms 3 to 6 dm. high, rather long, conduplicate leaves and open, capillary panicles 10 to 30 cm. long.—In bogs and pine barrens, Long Island and New Jersey. September, October.

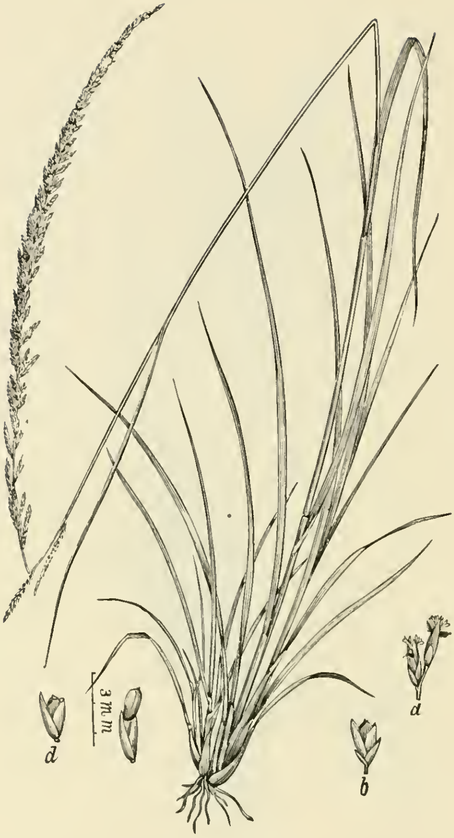


FIG. 126. **Sporobolus indicus** (L.) R. Br. SMUT-GRASS.—A tufted, wiry, erect perennial 3 to 9 dm. high, with simple culms and narrow, densely flowered, spike-like panicles 10 to 30 cm. long.—Abundantly naturalized in waste ground, waysides, fields, and pastures. Virginia and Tennessee to Florida, Arkansas, Texas, and California; occasional in the Eastern cities. [Native or naturalized in all tropical countries.] March–September.

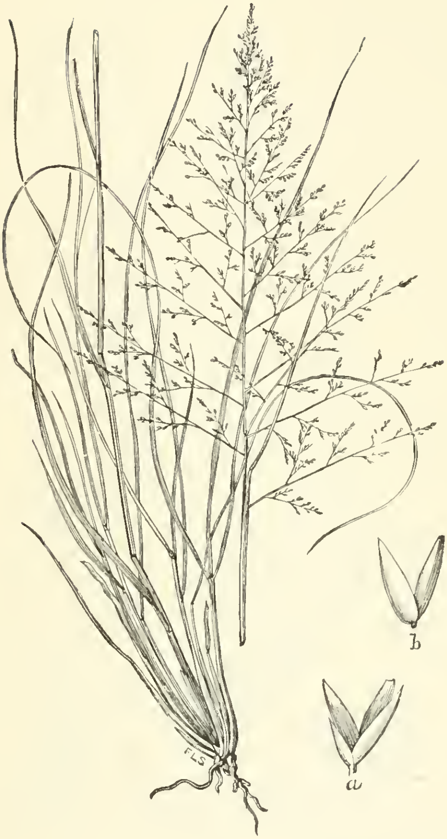


FIG. 127. **Sporobolus airoides** Torr. FINE-TOP SALT-GRASS.—A stout, coarse, and rigid perennial 3 to 9 dm. high, with long, narrow leaves and open, spreading panicles of many small spikelets.—Moist or dry, usually saline or alkaline soil in deserts, prairies, along streams, in meadows, etc., Nebraska and Kansas to Idaho, California, Texas, and Arizona. [Mexico and Lower California.] July–September.

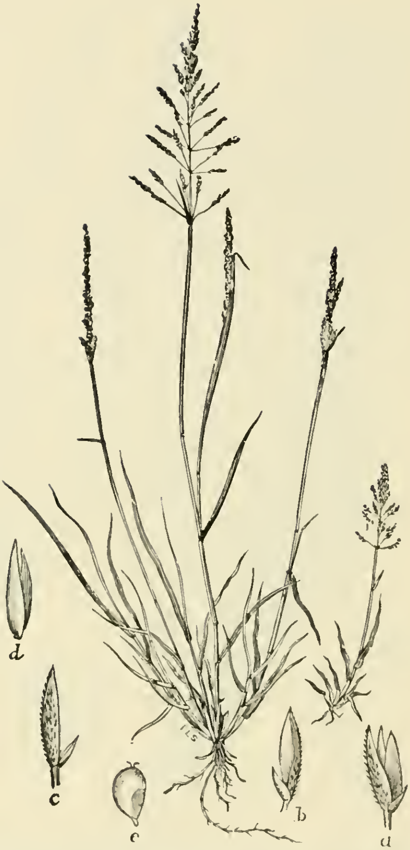


FIG. 128. **Sporobolus argutus** (Nees) Kunth (*Vilfa arguta* Nees.); Beal, Grasses N. Am., **2**: 301.—A cæspitose perennial 2 to 4 dm. high, with flat leaves and open (at first strict) panicles 3 to 5 cm. long.—"Sand dunes and sandy flats near river banks," Kansas and Colorado to Texas and western Louisiana, also in southern Florida. [Mexico and West Indies.] May–September

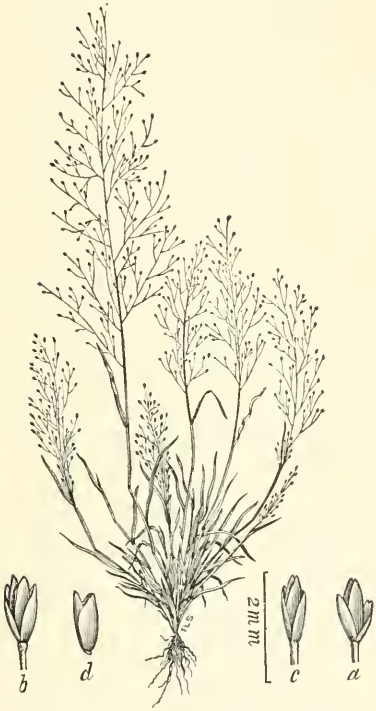


Fig. 129. **Sporobolus confusus** (Fourn.) Vasey; Beal, Grasses N. Am., **2** : 294.—A slender, branching, tufted annual 0.8 to 2 dm. high, with loose sheaths, flat leaves, and capillary, ovoid or oblong panicles 8 to 15 cm. long.—Sandy banks of streams, moist places in sandy plains, canyons, etc., Texas to California, and in Colorado and Montana. [Mexico.] July–September.

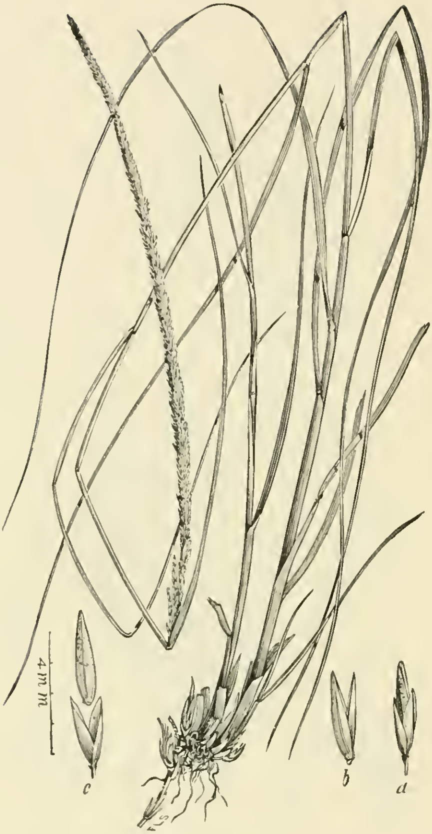


FIG. 130. **Epicampes rigens** (Boland.) Benth.; Beal, Grasses N. Am., **2**: — (*Cinna macroura* Thurb. not Kunth; *Vilfa rigens* Boland. not Trin.). DEER-GRASS.—A stout, erect perennial, with rigid, wiry culms 9 to 12 dm. high; long, narrow leaves and very long, narrow, and densely flowered spike-like panicles.—In the foothills, Texas to Nevada, New Mexico, Arizona, and southern California. [Mexico.] July–November. A bunch-grass of some agricultural value.

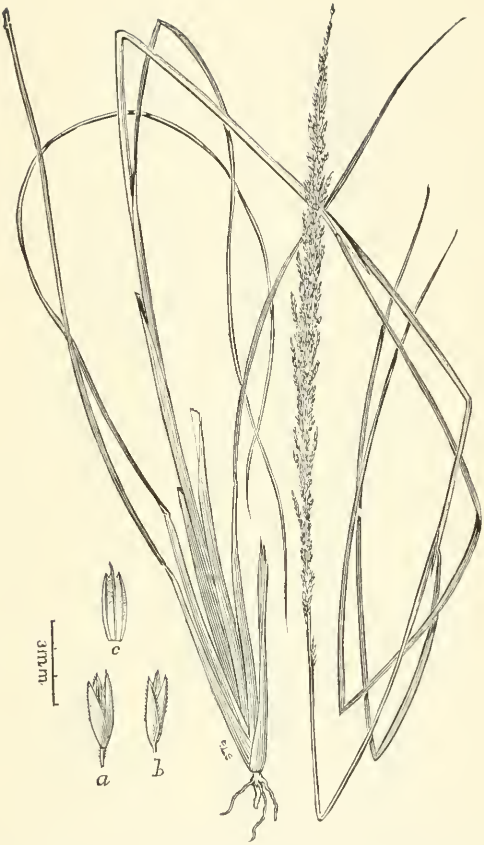


FIG. 131. **Epicampes ligulata** Scribn. sp. nov.—A stout, rigid perennial 6 to 12 dm. high, with narrow, very scabrous leaves and strict, rather densely flowered panicles 20 to 40 cm. long. Leaves long-attenuate pointed, rigid, and subinvolute at the base, where they are much narrower than the rigid ligule, which is 10 to 30 mm. long. Spikelets dark purple, glumes subequal.—Cool slopes and canyons, mountains of New Mexico and Arizona. [Mexico.] August, September.

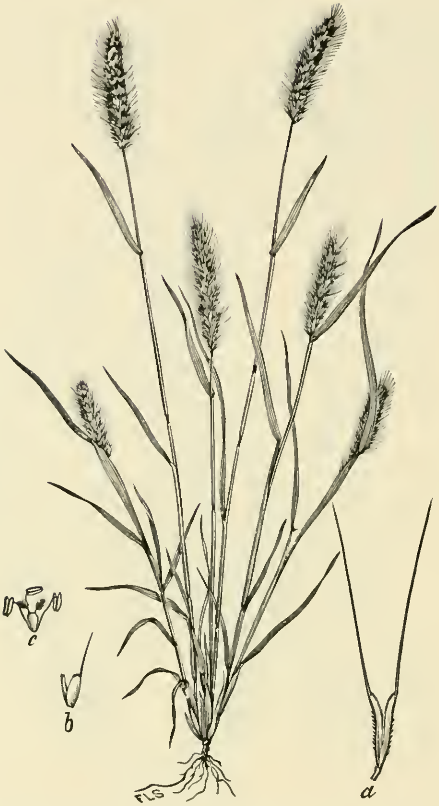


FIG. 132. **Polypogon monspeliensis** (L.) Desf. BEARD-GRASS.—A smooth annual from a few centimeters to 6 to 9 dm. high, with awned 1-flowered spikelets crowded in dense spike-like panicles.—In fields and waste places, sparingly naturalized along the Atlantic Coast from New Hampshire to South Carolina; abundantly on the Pacific Slope from California to Vancouver Island, and in Arizona, Nevada, and Colorado. [Europe and Asia.] April–October.

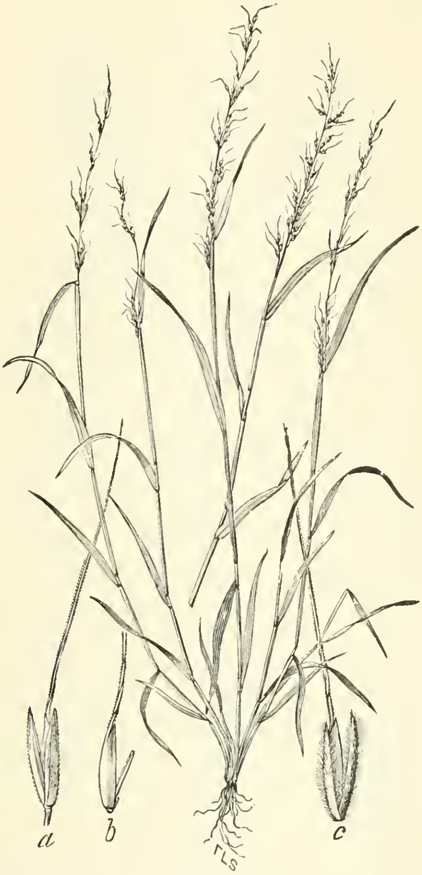


FIG. 133. **Limnodia arkansana** (Nutt.); Dewey in Contrib. U. S. Nat. Herb., **2**: 518 (*Greenia arkansana* Nutt.; *Thurberia arkansana* Benth.).—A slender annual 2 to 6 dm. high, more or less geniculate at the lower nodes, with soft, flat leaves and narrow, loosely flowered panicles 8 to 18 cm. long. Outer glumes scabrous or pilose.—Shell banks, woods, etc., western Florida to Arkansas and southern Texas. April–June.

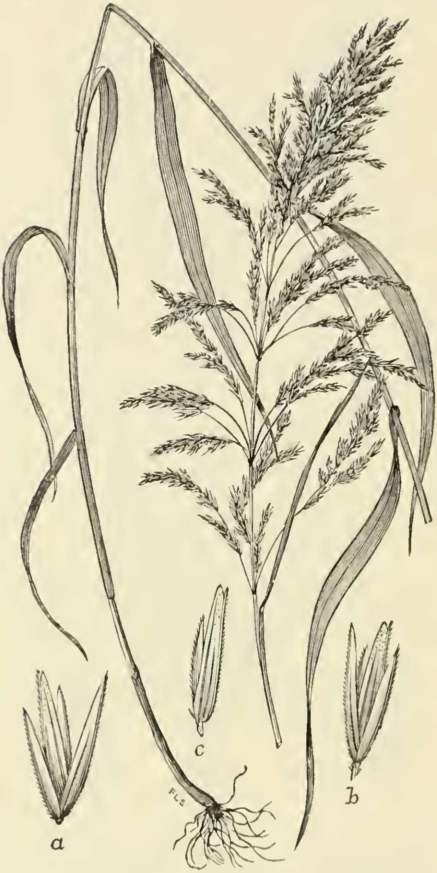


FIG. 134. **Cinna arundinacea** L. INDIAN REED.—A tall, leafy grass 9 to 21 dm. high, with simple culms, flat leaf blades, and ample terminal panicles.—Shaded swamps, banks of streams and low thickets, Newfoundland to North Carolina, Alabama, Texas, South Dakota, and the Northwest Territory. May–September.

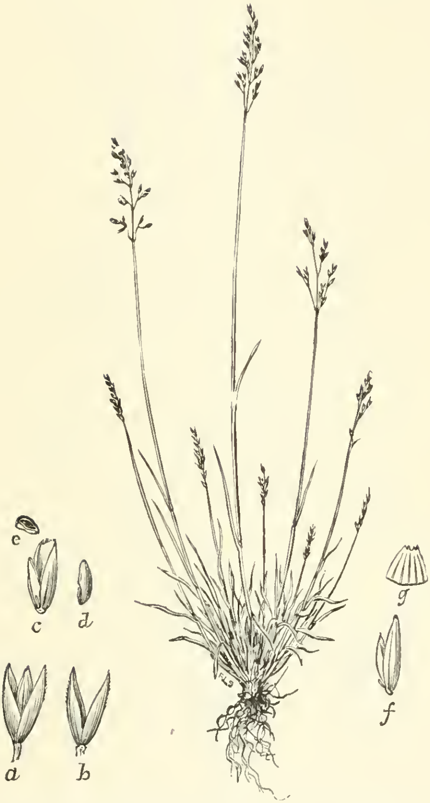


FIG. 135. **Agrostis humilis** Vasey (*A. varians* Trin.? not Thuill.).—A dwarf, slender perennial 6 to 12 cm. high, with short, flat leaves and contracted, purplish panicles 2 to 3 cm. long.—Moist meadows, or mossy and springy places, at 2,100 to 3,000 m. altitude on the mountains of Colorado, Wyoming, Washington, Oregon, and Montana. August, September.

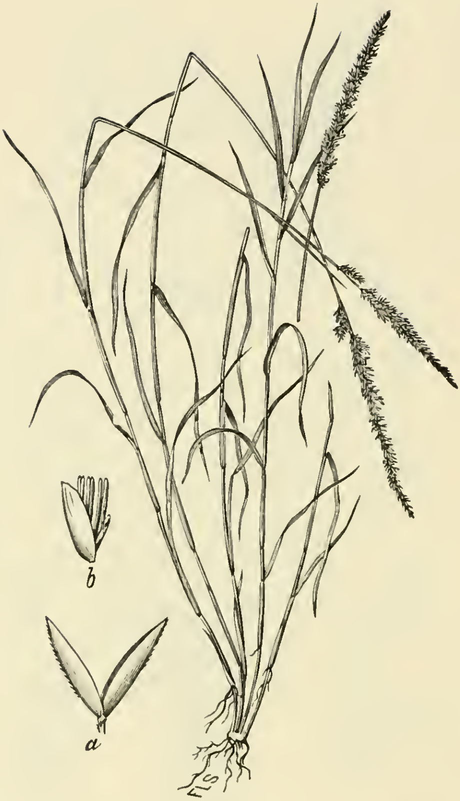


FIG. 136. **Agrostis coarctata** Ehrh. (*Stolonifera coarctata* Reichb).—A creeping perennial with slender culms, the upright branches about 3 dm. high, short, flat leaves and narrow, rather densely flowered panicles 5 to 10 cm. long.—Damp soil and sands along the coast, Newfoundland to New Jersey. [Europe.] July–October. A fine-leafed, excellent turf-forming species, valuable for lawns.

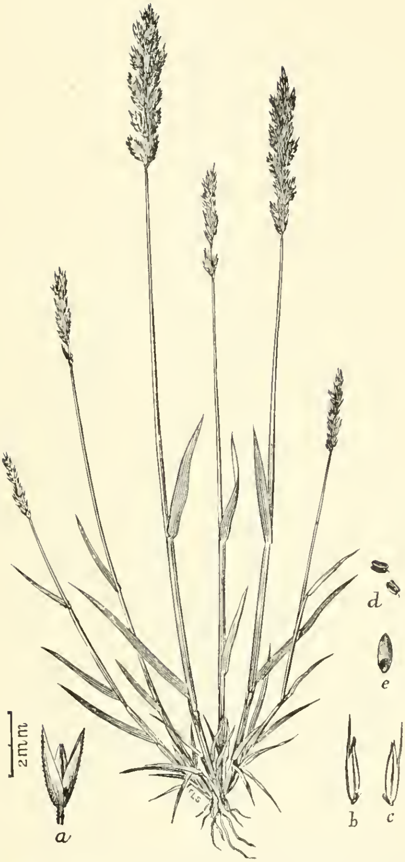


Fig. 137. **Agrostis densiflora** Vasey; Contrib. U. S. Nat. Herb., **3**: 72 (1892); Beal, Grasses N. Am., **2**: 326. Densely-flowered Bent.—A rather stout, caespitose perennial 1.5 to 4.5 dm. high, with short and comparatively broad leaves and densely, many-flowered, almost spike like panicles 3 to 8 cm. long.—Oregon and California, along the coast, apparently rare. July, August.

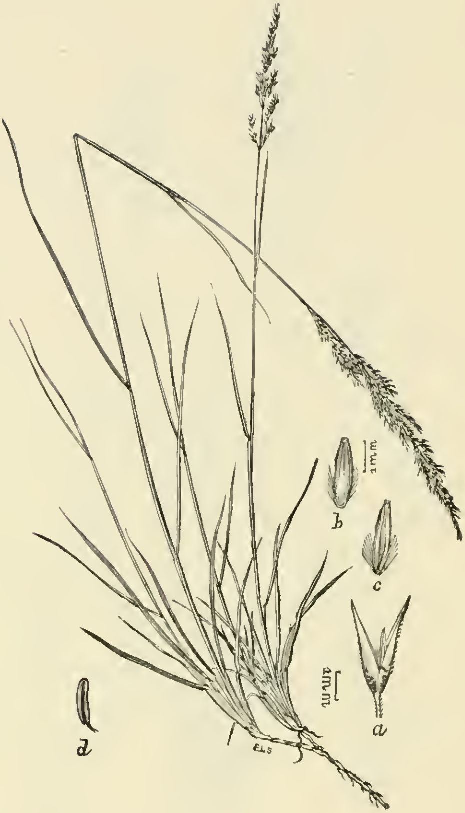


Fig. 138. **Agrostis pringlei** Scribn. sp. nov.—A strongly stoloniferous grass, with rather slender, upright or ascending culms 3 to 6 dm. high, narrow and rather rigid flat leaves, and loosely flowered, narrow panicles 5 to 15 cm. long. Flowering glumes much shorter than the acuminate outer ones, and remarkable for the long hairs on the callus.—Plains, Mendocino County, California (Pringle), and northward to Oregon (?). August.

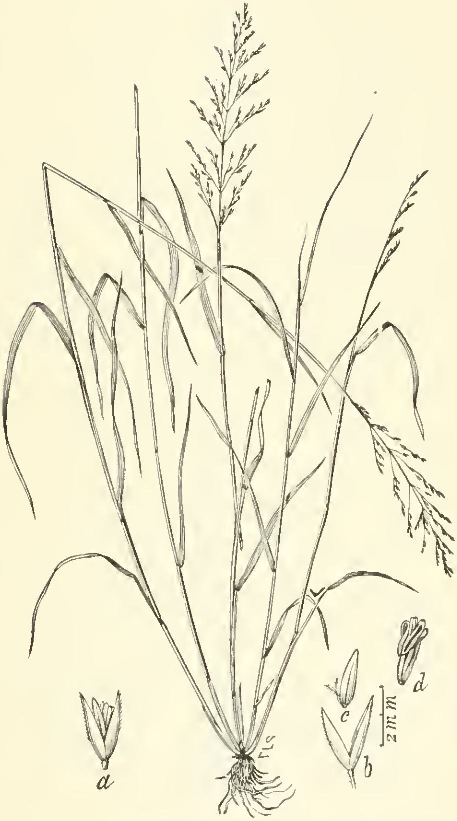


Fig. 139. **Agrostis diegoensis** Vasey (*A. foliosa* Vasey); Beal, Grasses N. Am., **2** : 328.—A strong-growing, leafy perennial 6 to 10 dm. high, from creeping rootstocks, with pale-green, narrow, and many-flowered panicles 15 to 20 cm. long. Spikelets 2 to 3 mm. long; flowering glume short-awned or awnless; palea wanting.—Mountains of southern California to Washington. May–August.

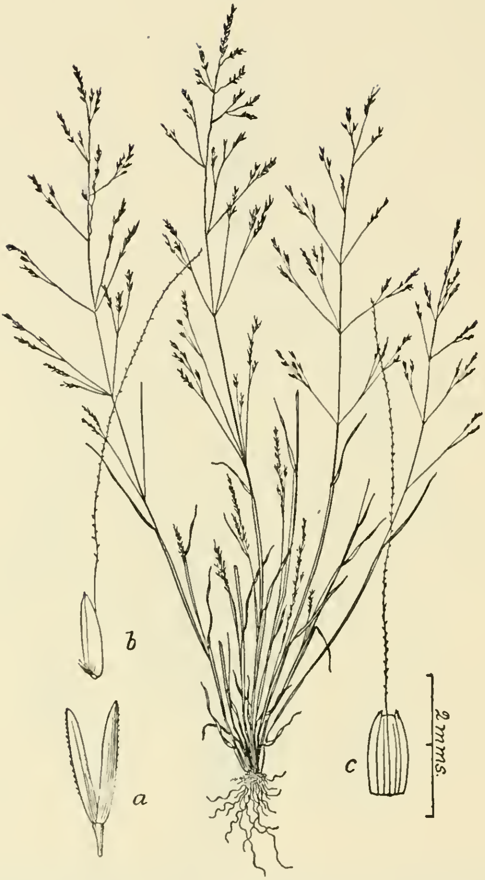


FIG. 140. **Agrostis elliottiana** Schult. (*A. arachnoides* Ell.). SPIDER BENT-GRASS.—A low, branching annual, rarely exceeding 3 dm. high, with narrow, flat leaves and diffuse, capillary panicles. The flowering glume bears a long and very slender awn.—Dry hillsides and old fields, South Carolina to Kentucky and Missouri, south to Florida and Texas. April, May.

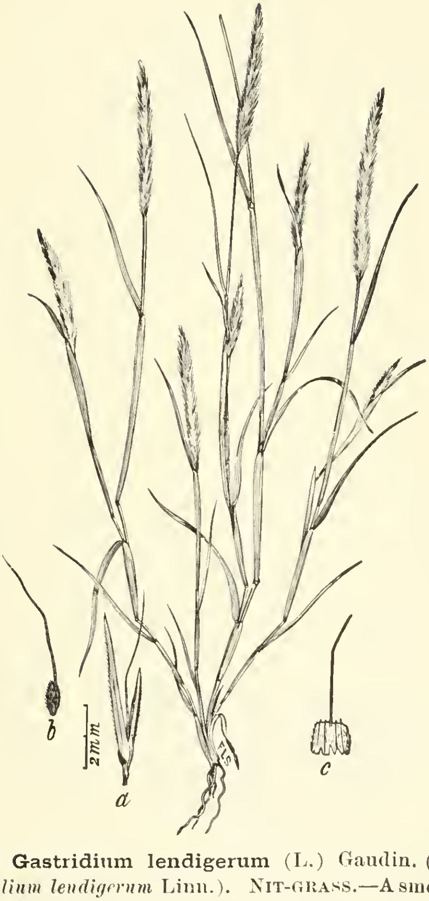


FIG. 141. **Gastridium lendigerum** (L.) Gaudin. (*G. australe* Beauv.; *Milium lendigerum* Linn.). NIT-GRASS.—A smooth annual 1.5 to 6 dm. high, with flat leaves and a strict, spike-like panicle 6 to 12 cm. long; cultivated for ornament.—Hills, naturalized, California and Oregon; also in Texas. [Southern Europe.] June, July.

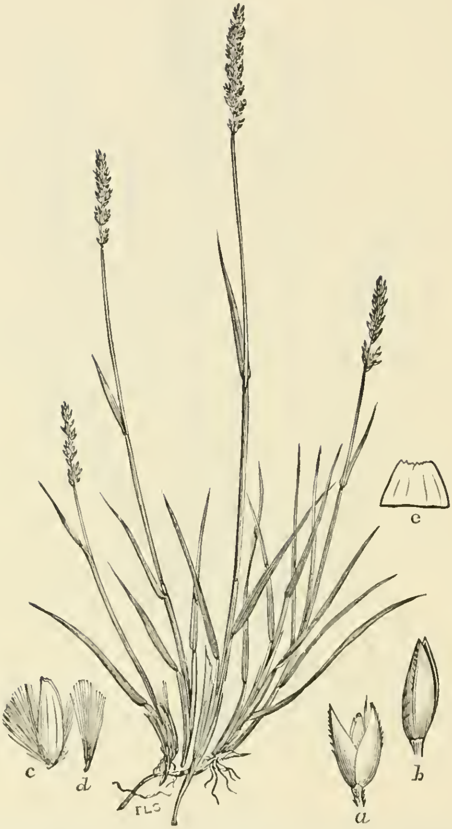


FIG. 142. **Calamagrostis crassiglumis** Thurb.; Beal, Grasses N. Am., **2** : 353 (as a var. of *C. neglecta*).—A rigid, erect perennial 1.5 to 4 dm. high, from creeping rootstocks, with long basal leaves and dense, oblong, spike-like panicles 4 to 6 cm. long.—Wet ground and gravelly lake shores, California to Vancouver Island. July, August.

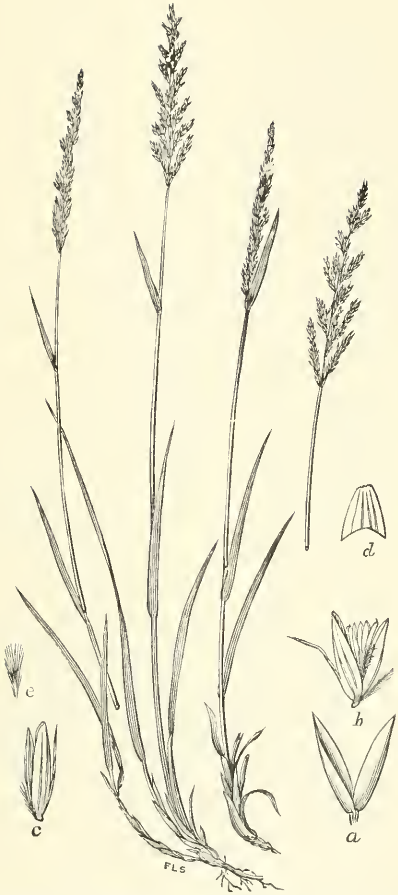


FIG. 143. **Calamagrostis breviseta** (A. Gray) Scribn.; Britton and Brown Ill. Fl., **1**: 164 (*C. pickeringii* A. Gray). SHORT-AWNED REED-GRASS.—A slender perennial 3 to 5 dm. high, with flat leaves and narrow or subpyramidal, rather densely flowered purplish panicles 8 to 12 cm. long.—Moist ground, Newfoundland, Cape Breton Island, and Labrador to New Hampshire, Vermont, and Massachusetts. July, August.

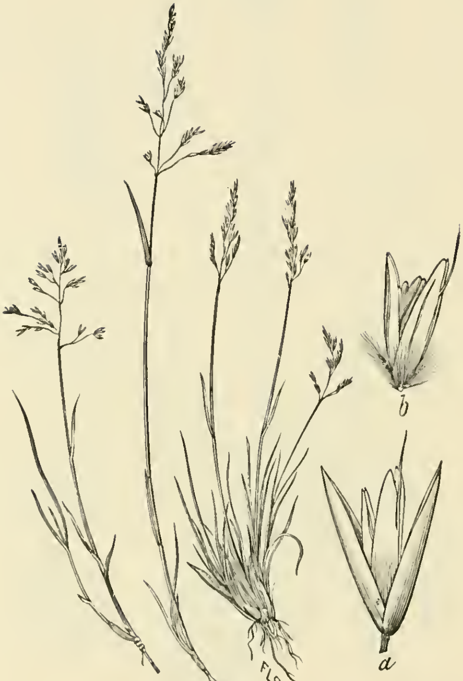


FIG. 141. **Calamagrostis deschampsioides** Trin.; Beal, Grasses N. Am., **2**: 339.—A slender perennial with culms 1.5 to 3 dm. high, from creeping rootstocks, with narrow leaves 3 to 7 cm. long and open, pyramidal panicles 4 to 8 cm. long.—Pribilof Islands, Alaska, southward to California. [Kamchatka.] August.

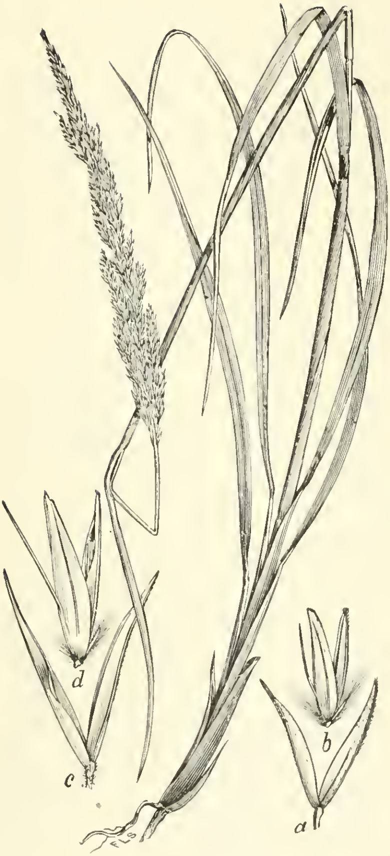


Fig. 145. **Calamagrostis aleutica** Trin.; Beal, Grasses N. Am., **2** : 346.—A stout, erect perennial 6 to 15 dm. high, with long and rather stiff, flat leaves and densely many-flowered, narrow panicles 15 to 30 cm. long.—Along the seashore, in rocky or marshy places, Alaska and Unalaska to California. June–September.

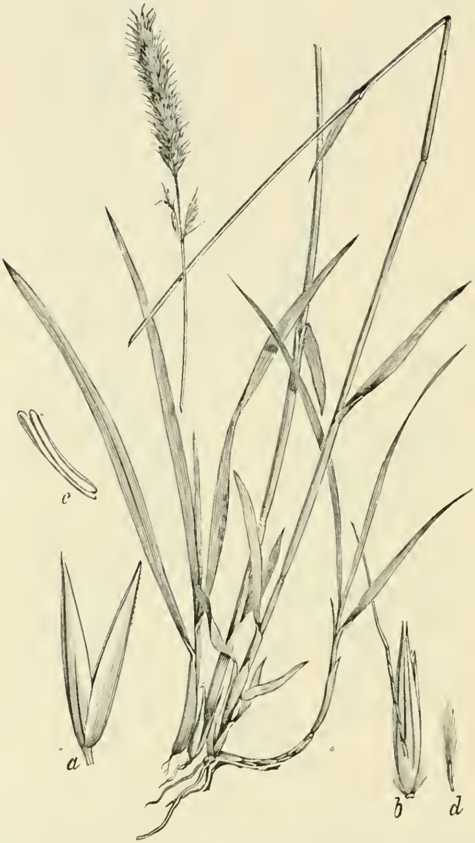


FIG. 146. **Calamagrostis tweedyi** Scribn.; Beal, Grasses N. Am., **2**: 348.—A stout perennial 7 to 10 dm. high, with rather broad, flat leaves and densely flowered, spike-like panicles 8 to 12 cm. long.—Cascade Mountains, Washington.

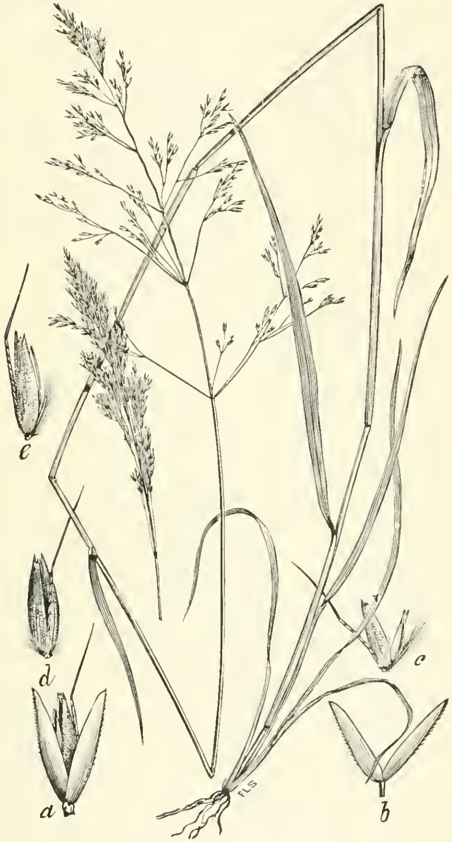


FIG. 147. **Calamagrostis bolanderi** Thurb.; Beal, Grasses N. Am., **2** : 352.—A stout perennial 6 to 15 dm. high, with flat leaves 10 to 30 cm. long and expanded, dark-purple panicles 8 to 20 cm. long.—Moist woodlands, northwestern California. August.

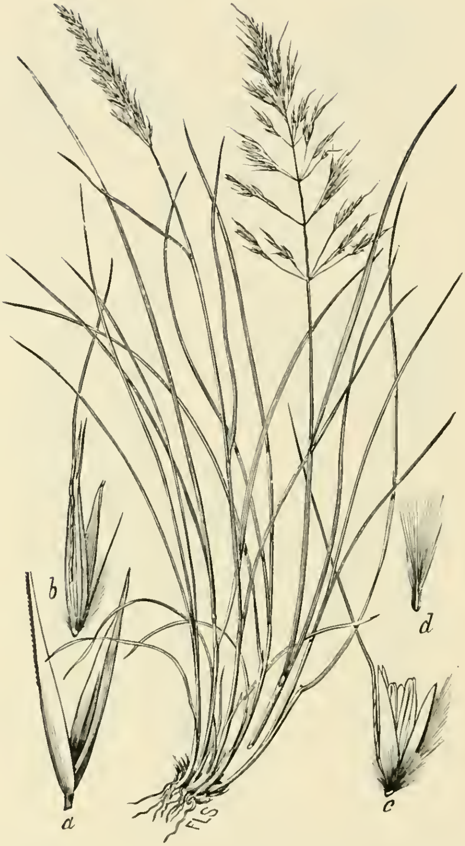


FIG. 148. **Calamagrostis howellii** Vasey; Beal, Grasses N. Am., **2**: 339.—A densely cæspitose, erect, leafy perennial 2.5 to 5 dm. high, with long and narrow basal leaves and open panicles 8 to 15 cm. long. Spikelets long-awned.—High mountains, Oregon and Washington. June–August.

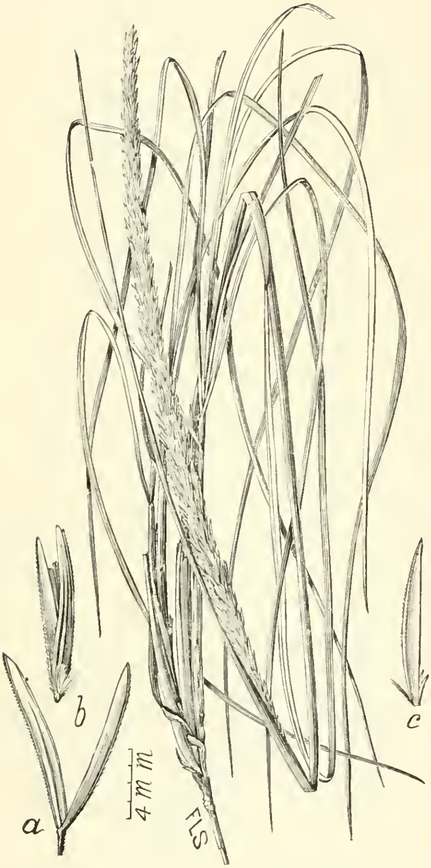


FIG. 149. **Ammophila arenaria** (L.) Link (*A. arundinacea* Host.). BEACH-GRASS, MARRAM-GRASS.—A coarse, erect perennial, with creeping rootstocks, rigid culms 6 to 12 dm. high, long leaves, and narrow, densely flowered, spike-like terminal panicles 12 to 25 cm. long.—Sandy coasts of the Atlantic from New Brunswick south to Virginia, and shores of the Great Lakes. [Europe.] July-October.

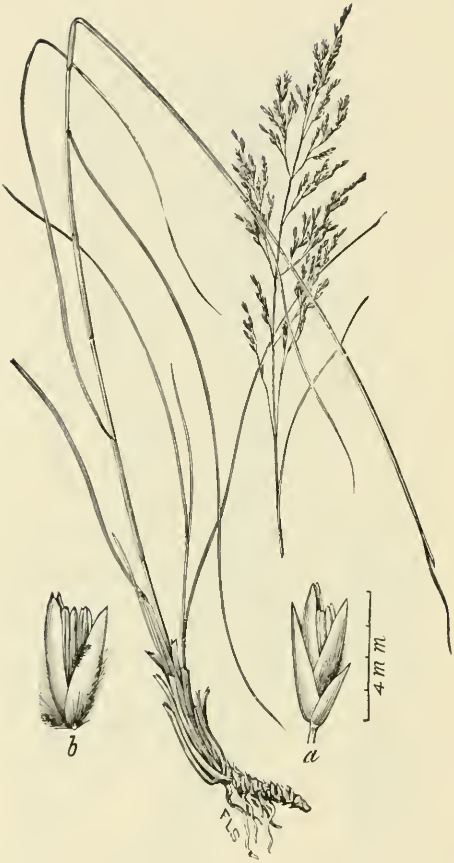


FIG. 150. **Calamovilfa brevipilis** (Torr.) Scribn. (*Arundo brevipilis* Torr.). SHORT-HAIRED REED-GRASS.—A rather slender, smooth perennial 9 to 12 dm. high, with very narrow leaves and open panicles 8 to 24 cm. long.—Sandy swamps in the pine barrens of New Jersey. August, September.

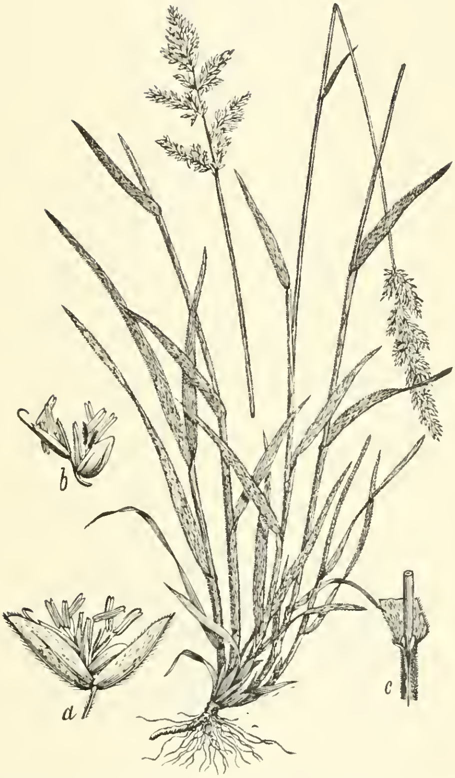


Fig. 151. **Holcus lanatus** L. Velvet Grass.—A perennial 3 to 6 dm. high, with creeping rootstocks, flat leaves, and open panicles 5 to 8 cm. long; usually densely pubescent all over with soft, whitish hairs.—Introduced into this country from Europe with other grasses and now widely distributed. May–August.

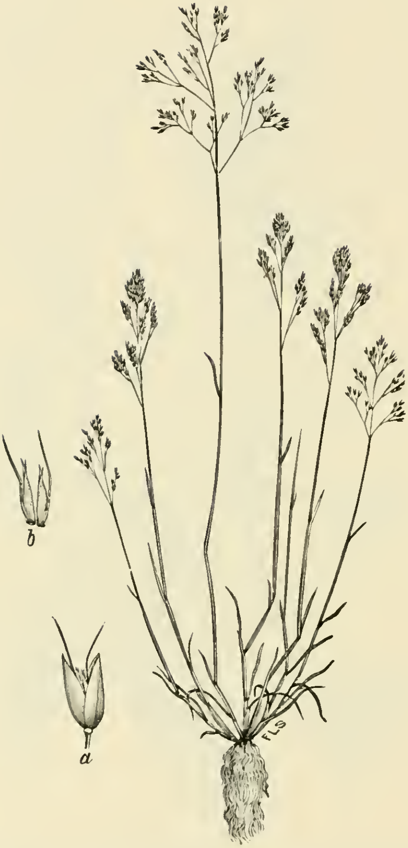


FIG. 152. **Aira caryophyllea** L. SILVERY HAIR-GRASS.—A slender, tufted annual 1 to 3 dm. high, with short leaves and small-flowered, open panicles 2 to 8 cm. long.—In sandy waste places, Massachusetts to Virginia; also on the Pacific Coast. Introduced from Europe. May–August.

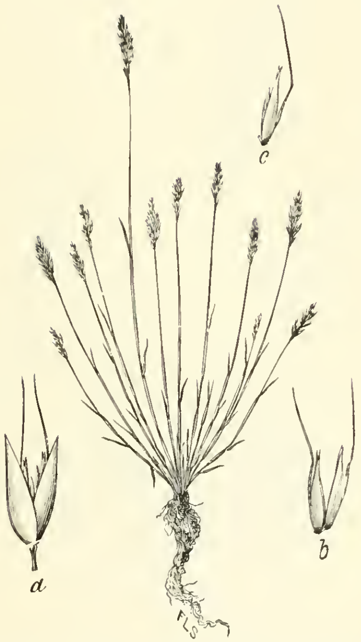


FIG. 153. **Aira præcox** L. EARLY WILD OAT-GRASS.—A tufted, erect or ascending annual 2 to 12 cm. high, with a contracted panicle 1 to 2 cm. long.—Introduced and sparingly distributed in the Middle States near the coast, growing in sandy soil. Also on Vancouver Island. [Europe.] May–July.

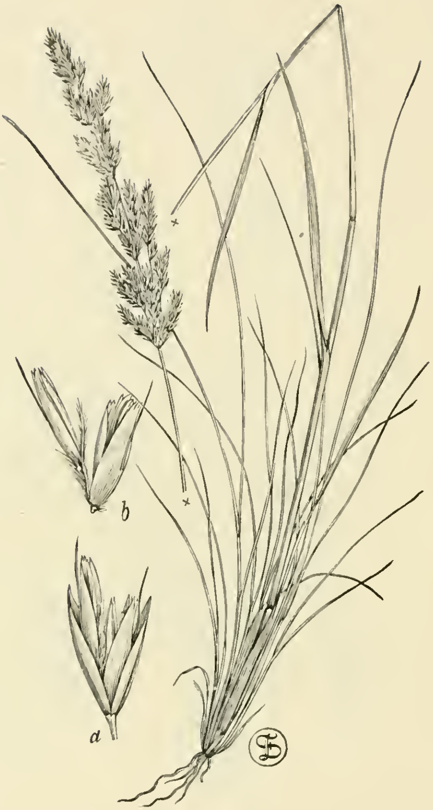


Fig. 154. **Deschampsia holciformis** Presl.; Beal, Grasses N. Am., **2**: 370. Californian Hair-grass.—A stout, erect perennial 6 to 15 dm. high, with long and rather rigid basal leaves and densely flowered, more or less interrupted panicles 12 to 24 cm. long.—Moist meadows, California near the coast. April.

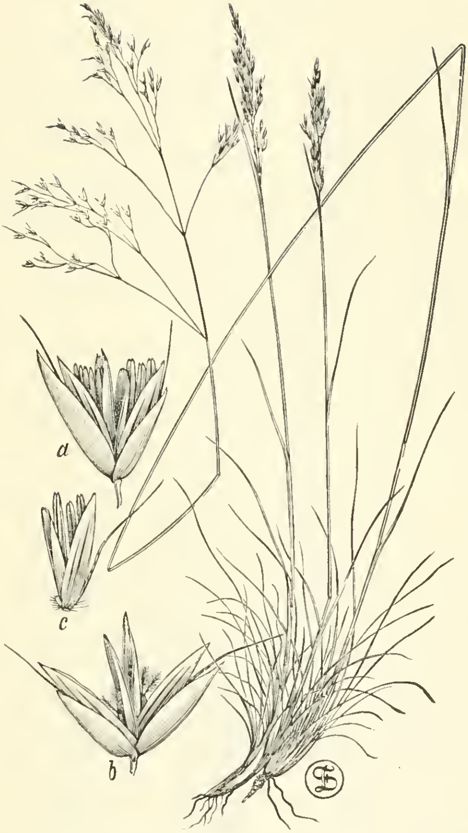


Fig. 155. **Deschampsia flexuosa** (L.) Trin. Tufted Hair-grass.—A slender, erect perennial about 6 dm. high, with involute-setaceous, radical leaves and diffuse panicles.—Labrador southward along the mountains to North Carolina and Tennessee, and westward from New York to Wisconsin. [Greenland and Europe.] May–August.

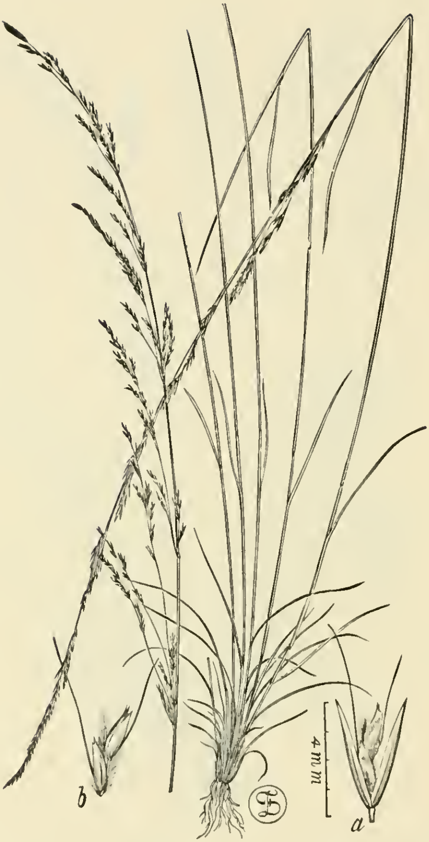


FIG. 156. **Deschampsia elongata** (Hook.) Munro; Beal, Grasses N. Am., **2**: 371. SLENDER HAIR-GRASS.—A slender perennial 3 to 12 dm. high, with narrow panicles 15 to 38 cm. long.—Montana to British Columbia and southward on the Pacific Slope to Mexico. May–August.

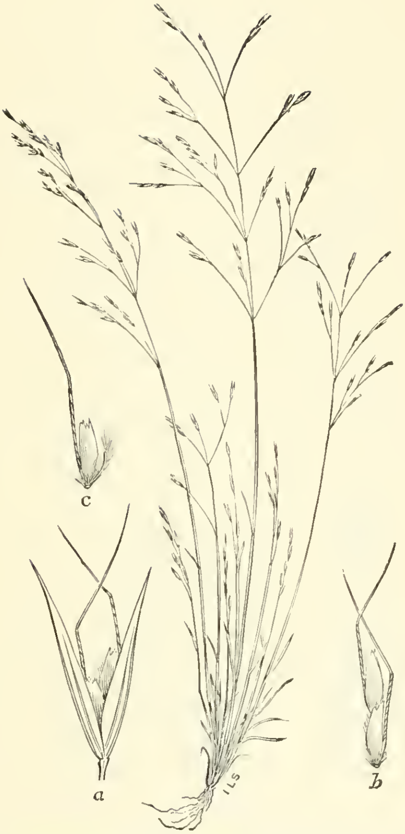


FIG. 157. **Deschampsia calycina** Presl (*Aira danthonioides* Trin.). OAT-LIKE HAIR-GRASS.—A rather slender, erect, cæspitose grass from 1 to 7 dm. high, with more or less spreading panicles.—Native along the Pacific Slope from Canada to California, eastward to Utah, and southward through Mexico to Peru. April–July.

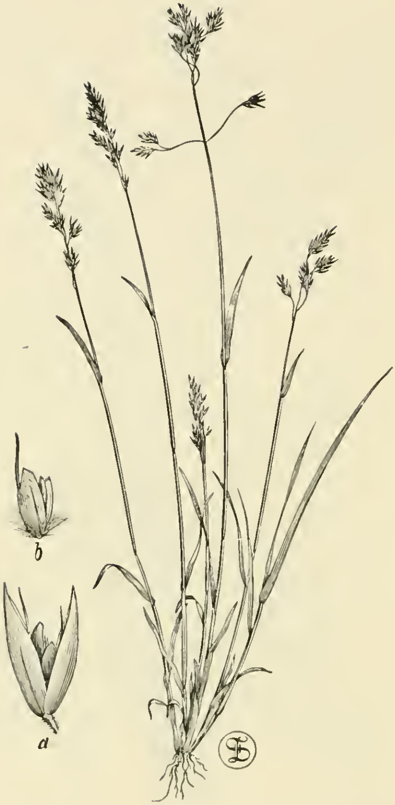


Fig. 158. **Deschampsia atropurpurea** (Wahl.) Scheele. Mountain Hair-grass.—A slender, alpine grass 1.5 to 4 dm. high, with flat leaves and few-flowered, nodding panicles 3 to 12 cm. long.—Labrador, White Mountains, Adirondacks, Rocky Mountains in Colorado, northward to Alaska. [Northern Europe and Asia.] July–September.

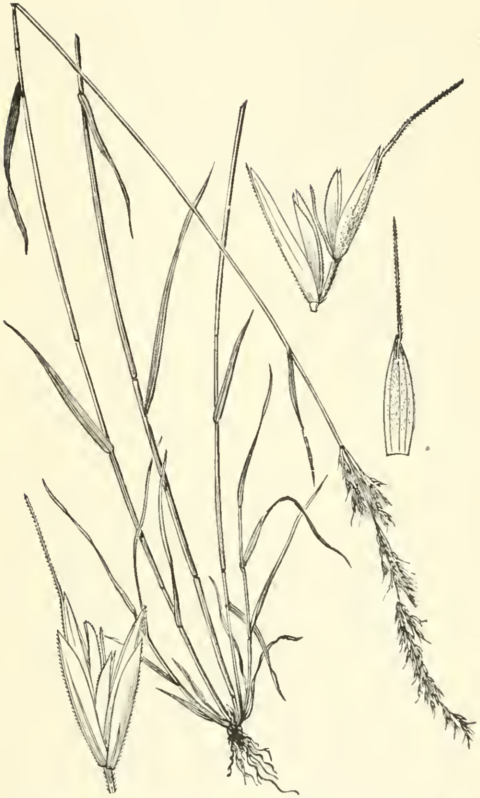


FIG. 159. **Trisetum palustre** (Michx.) Torr. MARSH OAT-GRASS.—A slender, loosely tufted perennial 6 to 9 dm. high, with flat, soft leaves and loosely flowered, nodding, and yellowish green panicles.—On moist rocks, along brooks, in wet meadows, etc., Massachusetts to Illinois, south to Florida and Louisiana; British Columbia. April–June.

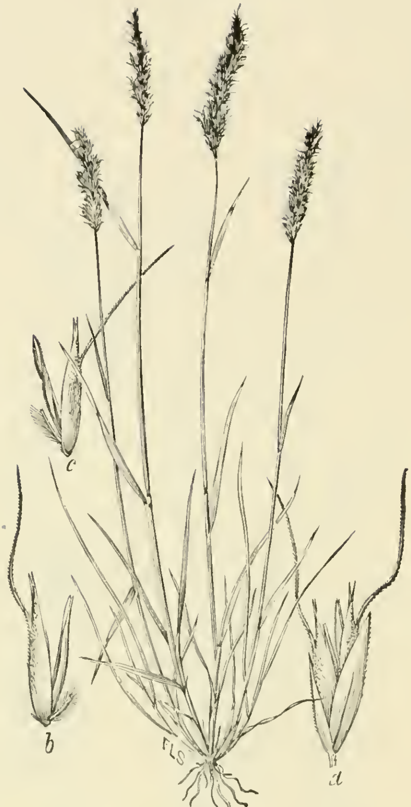


FIG. 160. **Trisetum subspicatum** (L.) Beauv. (*Aira subspicata* L.). DOWNY OAT-GRASS.—A slender, erect perennial 1.5 to 4.5 dm. high, with usually downy culms and leaves and densely many-flowered, spike-like panicles.—Widely distributed in the cooler temperate regions of both hemispheres, ranging in North America from Labrador to Alaska and extending southward in the Eastern States to the mountains of North Carolina and Tennessee, and in the West to New Mexico and California. June-September.

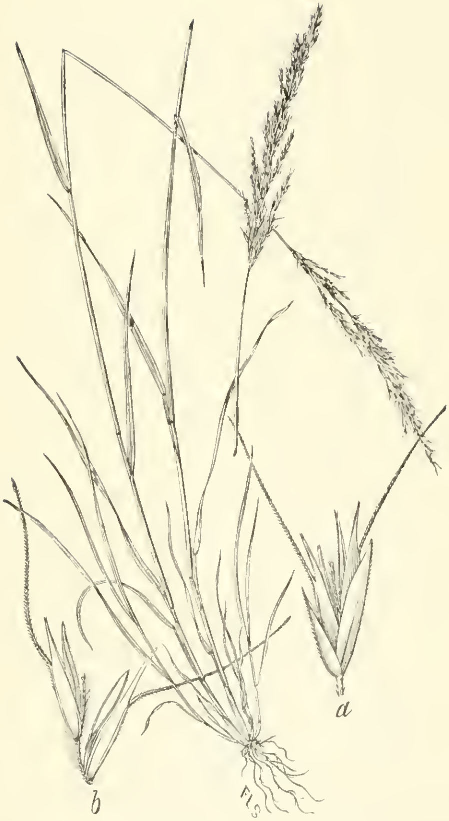


FIG. 161. **Trisetum montanum** Vasey; Beal, Grasses N. Am., **2**: 379. ROCKY MOUNTAIN OAT-GRASS.—A slender, erect, or ascending native grass 3 to 8 dm. high, with narrow, flat leaves and many-flowered, more or less contracted panicles 8 to 12 cm. long.—Mountains of Colorado and New Mexico. July, August.

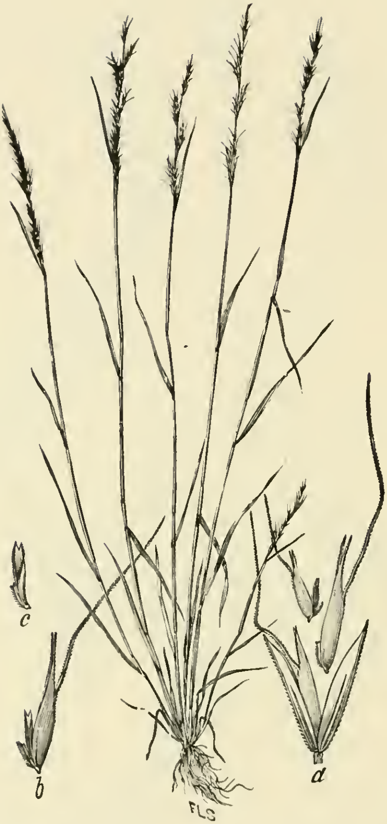


FIG. 162. **Trisetum interruptum** Buckl.; Beal, Grasses N. Am., **2**: 376, under *T. elongatum.* SLENDER OAT-GRASS.—A slender, erect annual 2 to 5 dm. high, with rather short, soft leaves and narrow, elongated panicles 4 to 10 cm. long.—Colorado to Texas, Arizona, and southern California. March–May.

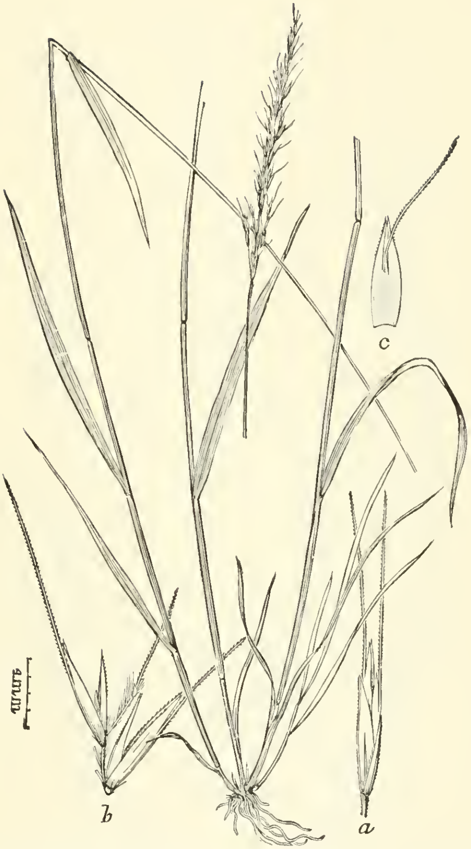


FIG. 163. **Trisetum canescens** Buckl.; Brewer and Wats., Bot. Calif., **2** : 296. SILVERY OAT-GRASS.—An erect perennial 3 to 12 dm. high, with flat leaves, and more or less densely flowered panicles 12 to 18 cm. long.—In dry, open ground, open woods, thickets, and wet meadows, California to British Columbia, east to Montana. May–September.

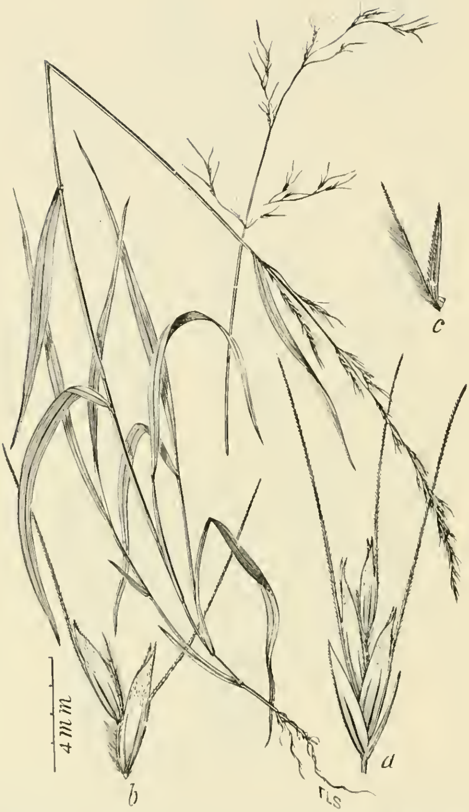


FIG. 164. **Trisetum cernuum** Trin.; Beal, Grasses N. Am., **2**: 379. NODDING OAT-GRASS.—A slender perennial 6 to 10 dm. high, with rather broad, flat leaves and loosely flowered, nodding panicles 12 to 20 cm. long.—Alaska to northern California and eastward to Idaho. May–July.

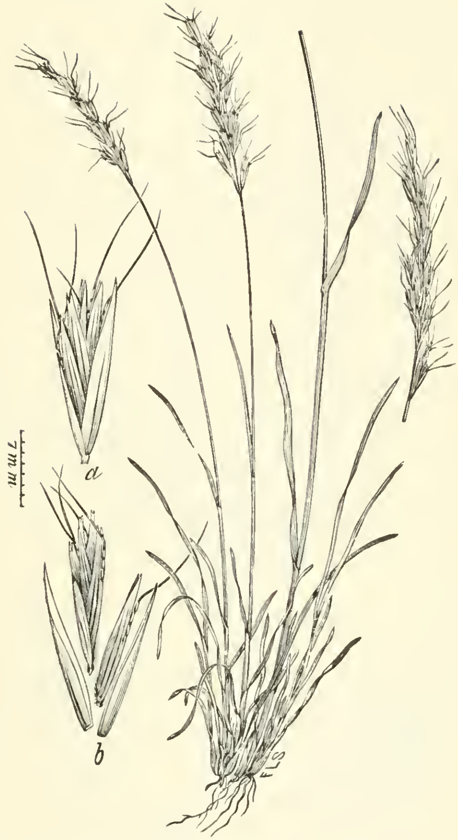


Fig. 165. **Avena americana** (Scribn.) (*A. pratensis* var. *americana* Scribn.; *A. hookeri* Scribn.). American Oat.—A rigidly erect perennial 3 to 6 dm. high, with narrow, firm leaves, and contracted panicles 8 to 12 cm. long.—Open thickets and prairies, Manitoba, and in the foothills of the Rocky Mountains southward to Colorado. June–August.

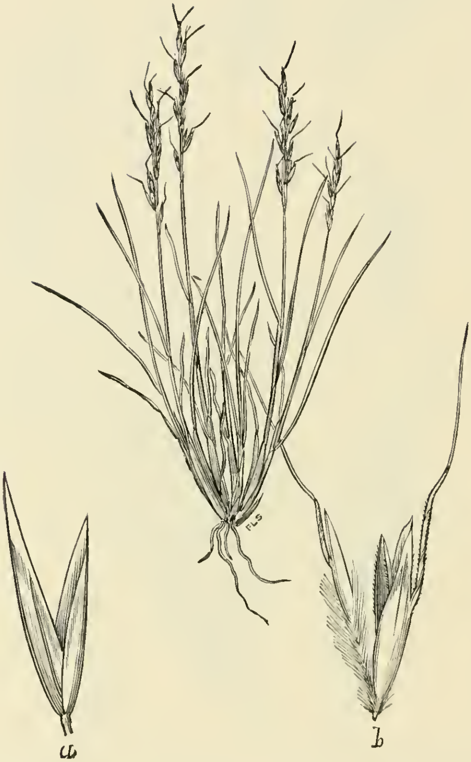


Fig. 166. **Avena mortoniana** Scribn.; Bot. Gaz., **21**: 133. Morton's Oat-grass.—A densely cæspitose, erect perennial 1 to 2.5 dm. high, with rather rigid leaves and narrow, simple panicles of one- to two-flowered spikelets.—At 3,900 to 4,200 m. altitude, mountains of Colorado. August.

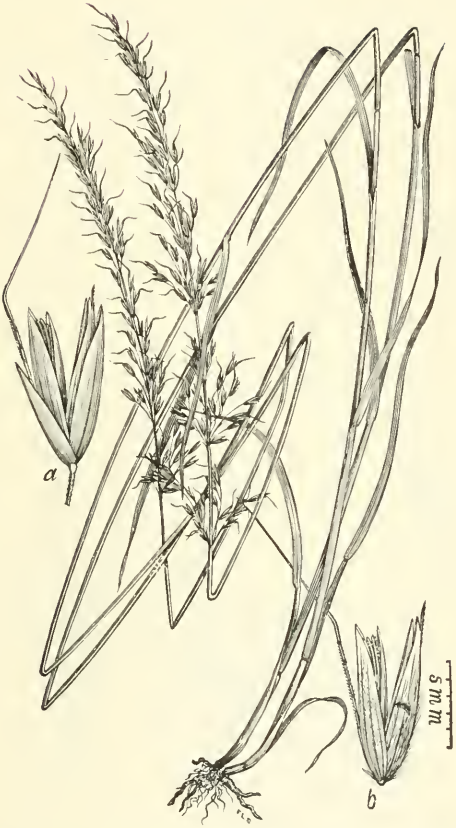


Fig. 167. **Arrhenatherum elatius** (L.) Beauv. (*Avena elatior* L.). Tall Oat-grass.—A loosely tufted perennial 6 to 12 dm. high, with flat leaves and narrow, loosely flowered panicles 15 to 20 cm. long.—Introduced from Europe as a fodder grass. Valuable; in Europe regarded as one of the best meadow grasses. May, June.

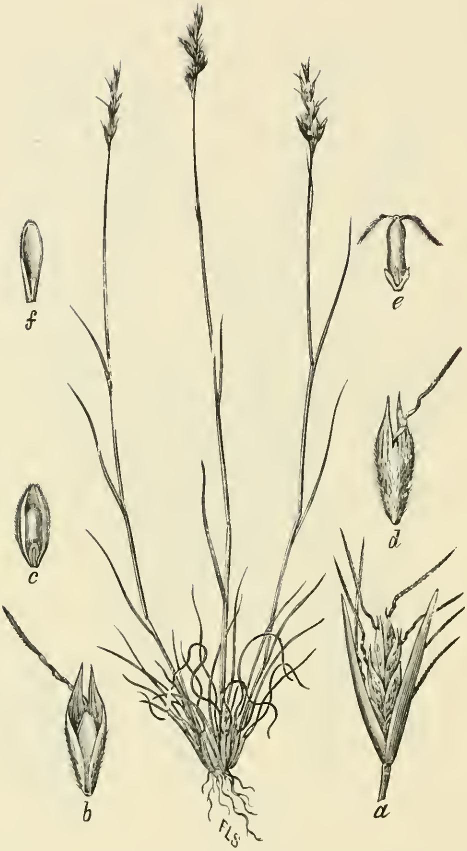


FIG. 168. **Danthonia spicata** (L.) Beauv. (*Avena spicata* L.). WILD OAT-GRASS.—A smooth, slender, erect perennial 2.5 to 5 dm. high, with a few-flowered, narrow panicle spreading only in flower.—Common in dry, thin soils from Canada southward to the Gulf States and westward to Texas. May–September.

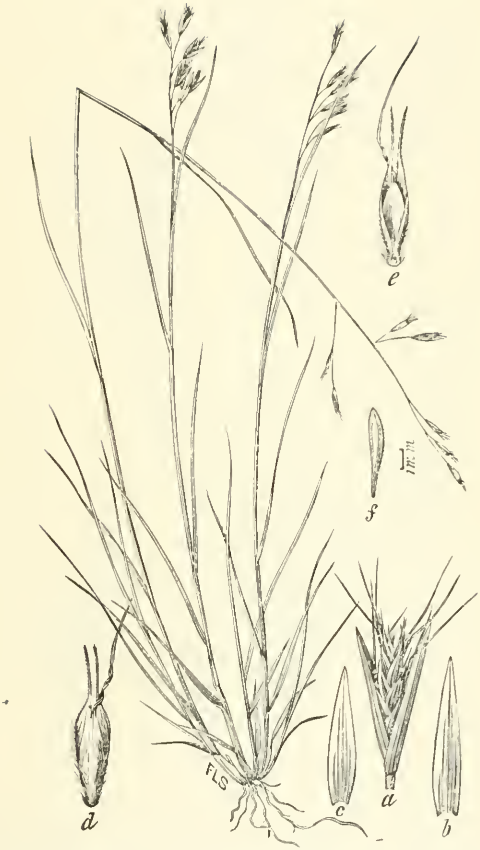


FIG. 169. **Danthonia compressa** Austin. TENNESSEE OAT-GRASS.—A slender, erect, tufted perennial 2 to 6 dm. high, with long, narrow root leaves, and few-flowered open panicles.—Mountain regions of eastern Tennessee and North Carolina northward to Canada. June–August.

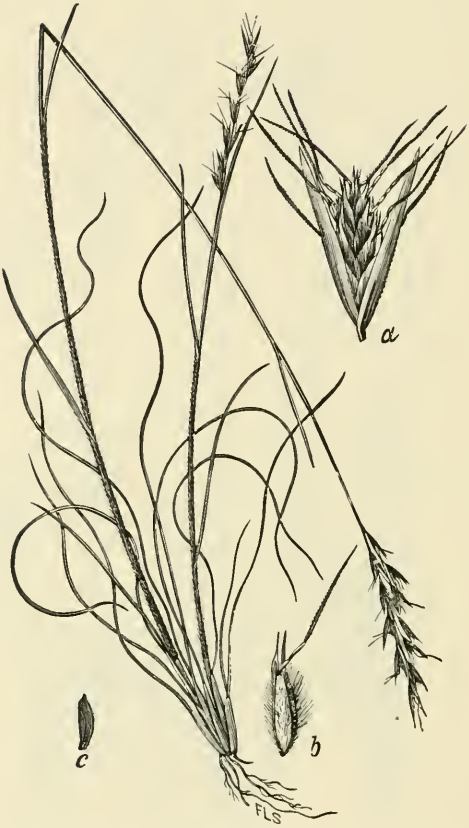


FIG. 170. **Danthonia sericea** Nutt. SILKY OAT-GRASS.—A rather stout, erect perennial 3 to 9 dm. high, with usually pubescent sheaths, rather rigid leaves, large spikelets, and terminal, few-flowered panicles.—Open woodlands in dry soil, Massachusetts and New Jersey to Florida and west to Tennessee and Alabama. May, June.

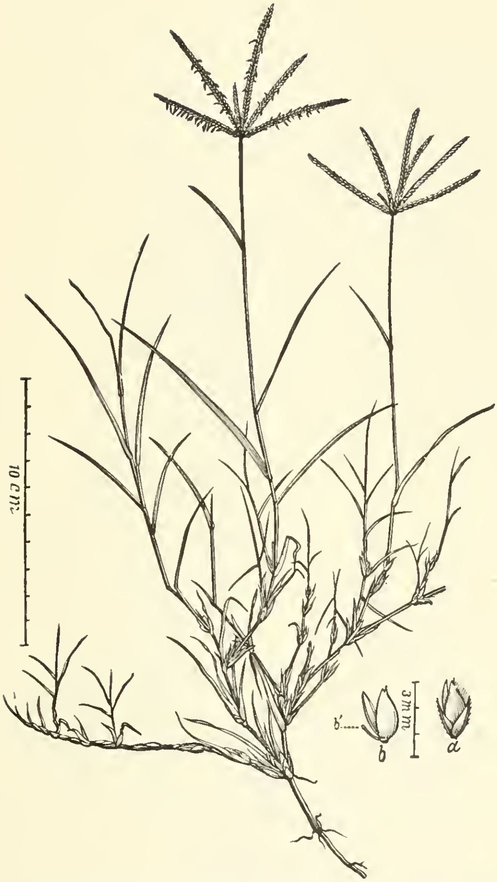


Fig. 171. **Capriola dactylon** (L.) Kuntze (*Panicum dactylon* L.; *Cynodon dactylon* Pers.). Bermuda-grass.—A creeping perennial, with upright or ascending, leafy flowering branches 1 to 6 dm. high.—Widely dispersed over the tropical and warmer temperate regions of the world, in the United States from Pennsylvania southward to Florida and westward to Texas and California. April–October. (The name *Capriola* may belong to *Panicum sanguinale*.)

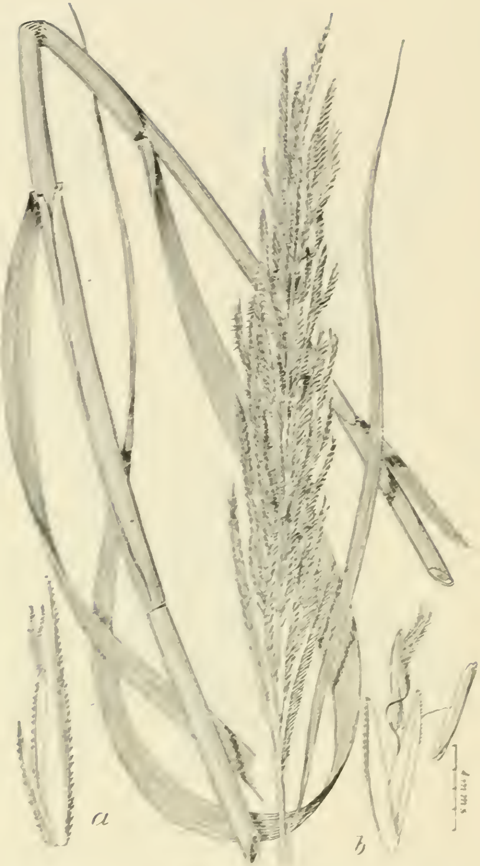


FIG. 172. **Spartina polystachya** (Michx.) Ell. (*Trachynotia polystachya*). SALT REED-GRASS.—A stout, erect perennial 12 to 27 dm. high with long, flat leaves and terminal panicles of twenty to fifty crowded, ascending spikes 5 to 10 cm. long.—Brackish marshes along the coast, Maine to Mississippi. July–October.

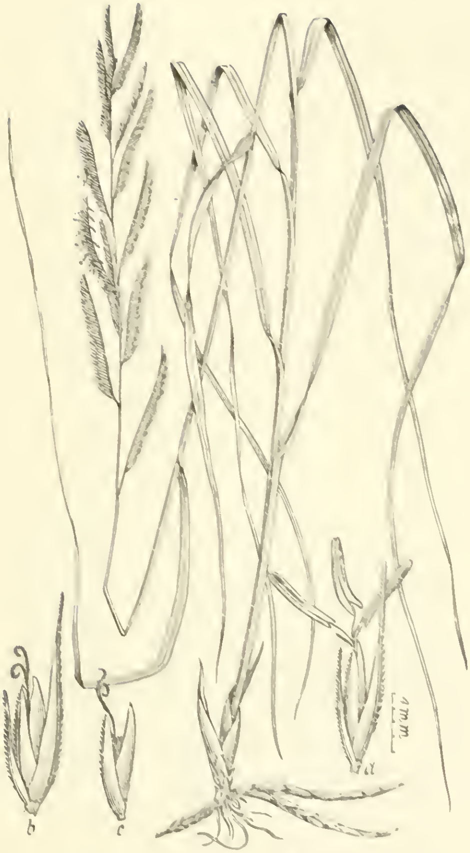


Fig. 173. **Spartina cynosuroides** (L.) Willd. Freshwater Cord-grass.—A stout, erect grass 6 to 18 dm. high, with unbranched, smooth culms from strong, scaly, creeping rootstocks, long, tough leaf blades, and five to twenty spikes, forming a terminal panicle.—River banks and lake shores, also brackish coast marshes, Maine and Nova Scotia to Assiniboia and Oregon, south to New Jersey, western Tennessee, Texas, and Colorado. July–October.

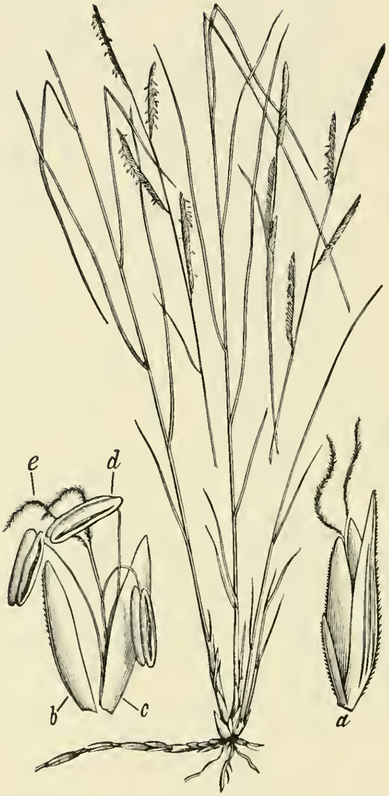


FIG. 174. **Spartina patens** (Ait.) Muhl. (*Dactylis patens* Ait.; *Spartina juncea* Ell.). FOX-GRASS.—A rather slender and somewhat wiry grass 3 to 6 (rarely 9) dm. high, with two to four slender, erect or widely spreading spikes.—Salt marshes and sandy shores along the coast from Newfoundland to Florida and westward to Texas. June–September.

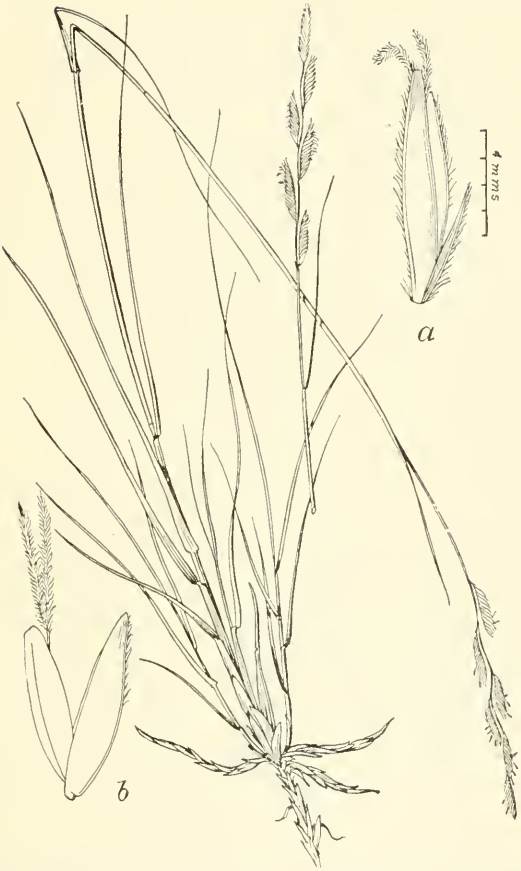


Fig. 175. **Spartina gracilis** Trin. Western Cord-grass.—A comparatively slender, perennial species 3 to 9 dm. high, with flat leaves, and three to nine rather short, appressed spikes.—Meadows, swamps, and river bottoms, especially in alkaline soils, South Dakota to Kansas, west to British Columbia, Nevada, and California. March–August.

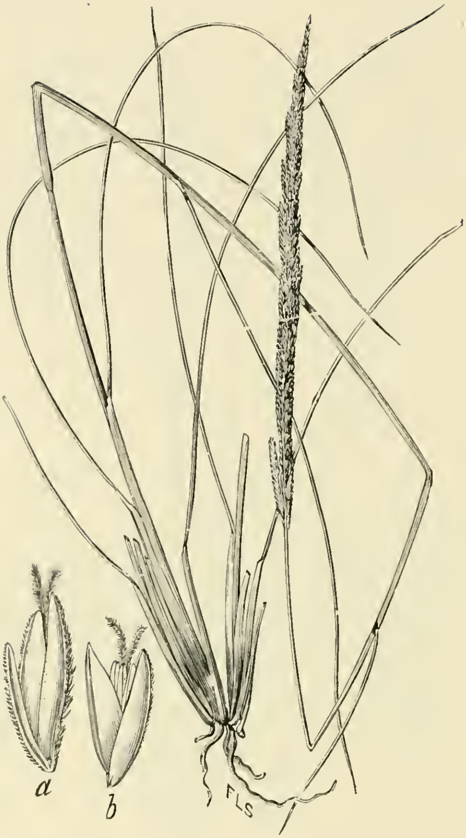


FIG. 176. **Spartina junciformis** Engelm. & Gray (*S. densiflora* Brongn. (?); *S. gouini* Fourn.); Beal, Grasses N. Am., **2**: 400. RUSH-LIKE SPARTINA.—A stout perennial 6 to 15 dm. high, with very long, narrow leaves and short, appressed spikes, which form a cylindrical, spike-like inflorescence 10 to 30 cm. long.—Brackish marshes along the Gulf Coast, Key West, Florida to Texas. [Mexico and Chile.?] June–October.

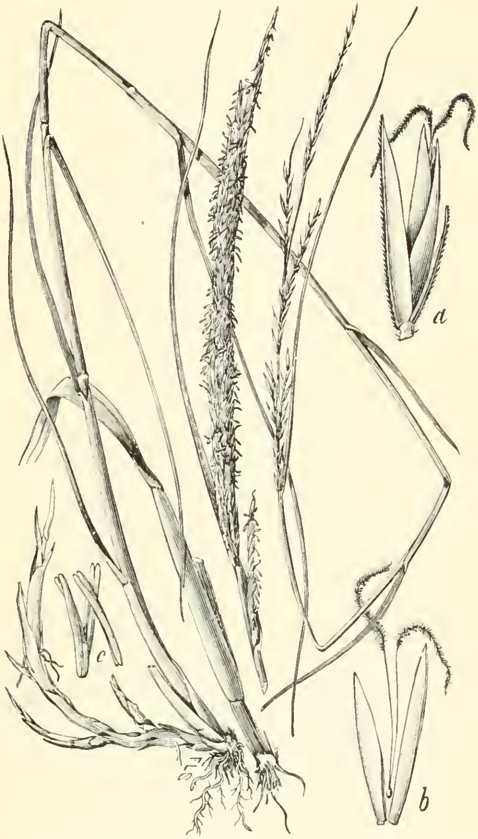


Fig. 177. Spartina stricta maritima (Walt.) Scribn. (*Dactylis maritima* Walt.; *Spartina glabra* Muhl.). Creek Sedge or Thatch.—An erect and often stout salt-marsh grass from 6 to 24 dm. high, with long, flat leaves and few to many, erect, appressed spikes.—Along ditches and creeks of the salt marshes of both the Atlantic and Pacific coasts. July–October.

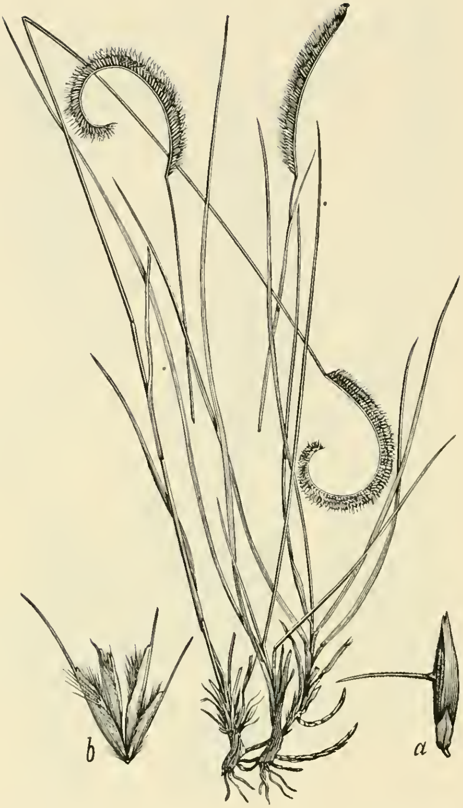


Fig. 178. **Campulosus aromaticus** (Walt.) Trin. (*Ægilops aromatica* Walt.; *Ctenium americanum* Spreng.). Toothache-grass.—An erect perennial 9 to 12 dm. high, from strong, lemon-scented and pungent rootstocks, with narrow leaves and usually a single, terminal, curved, pectinate spike 4 to 10 cm. long.—Southern Virginia to Florida and westward to Mississippi. July, August.

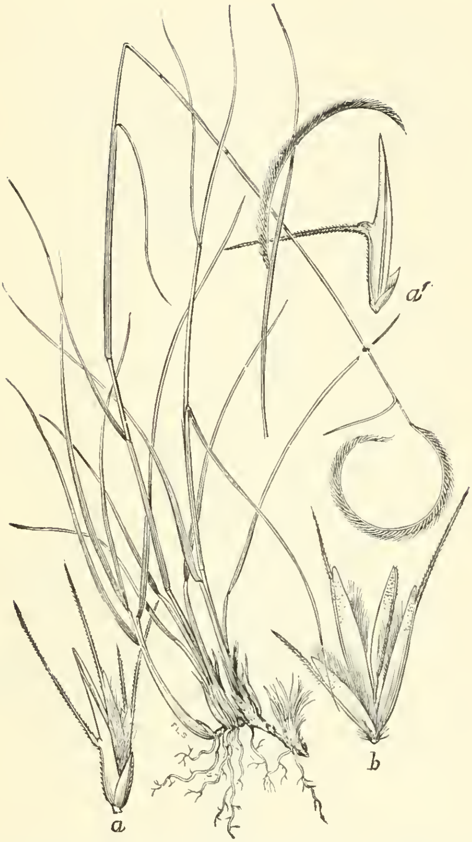


FIG. 179. **Campulosus chapadensis** Trin. (*Ctenium chapadense* Doell).—An erect perennial 8 to 12 dm. high, with narrow leaves and usually single, terminal, more or less curved spikes. More slender than *C. aromaticus*, with narrower glumes, and more delicate and longer awns.—Florida, in the "flat woods" regions. July–October.

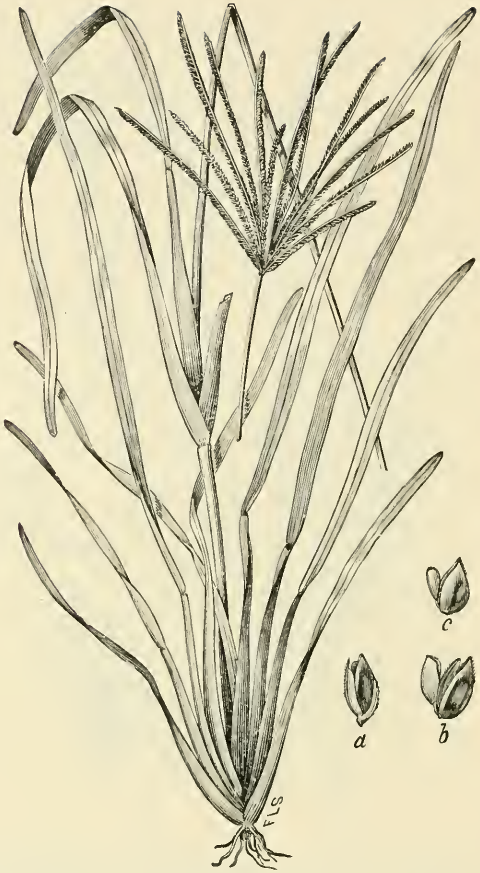


FIG. 180. **Chloris glauca** (Chapm.) Vasey (*Eustachys glauca* Chapm.); Beal, Grasses N. Am., **2**: 408. SMOOTH CHLORIS.—A strong-growing perennial, with diffusely spreading and ascending culms 6 to 12 dm. long, bearing 10 to 25 slender terminal spikes. Culms and sheaths strongly flattened.—Brackish marshes and along the borders of cypress swamps, Florida. July–September.

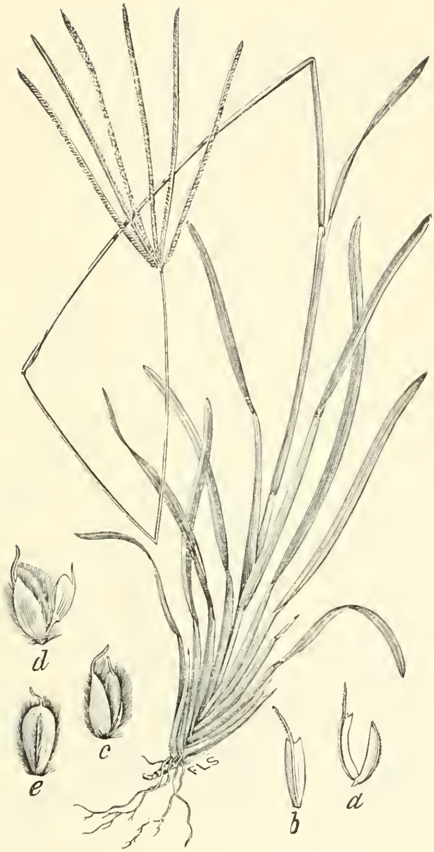


FIG. 181. **Chloris neglecta** Nash in Bull. Torr. Bot. Club., **22**: 423.—A rather stout perennial 6 to 12 dm. high, with compressed, glabrous culms and sheaths, flat leaves 10 to 35 cm. long, and four to six terminal spikes 8 to 12 cm. long. Closely allied to and much resembling *C. floridana*.—Low pine lands, Florida. October.

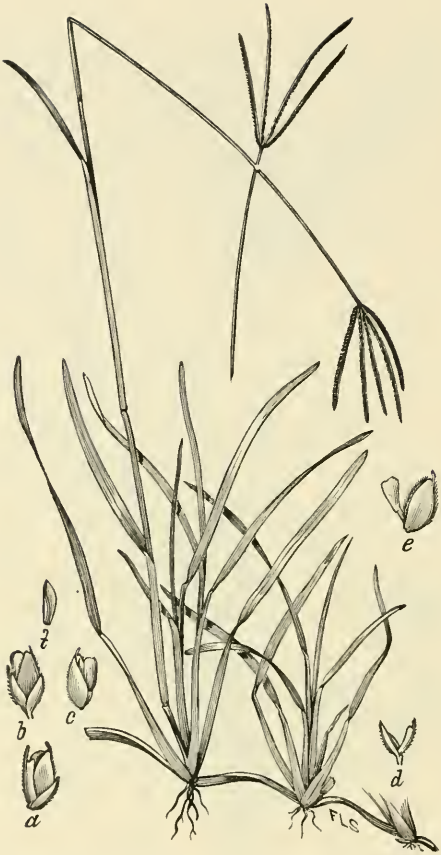


FIG. 182. **Chloris petræa** Sw.; Beal, Grasses N. Am., **2** : 408 (sub. *C. swartziana* Doell). SEASIDE FINGER-GRASS.—A creeping, glaucous perennial 3 to 6 dm. high, with obtuse, flat leaves and three to eight slender spikes 4 to 7 cm. long.—Southern Florida to southeastern Texas. [West Indies and Central and South America.] March–October.

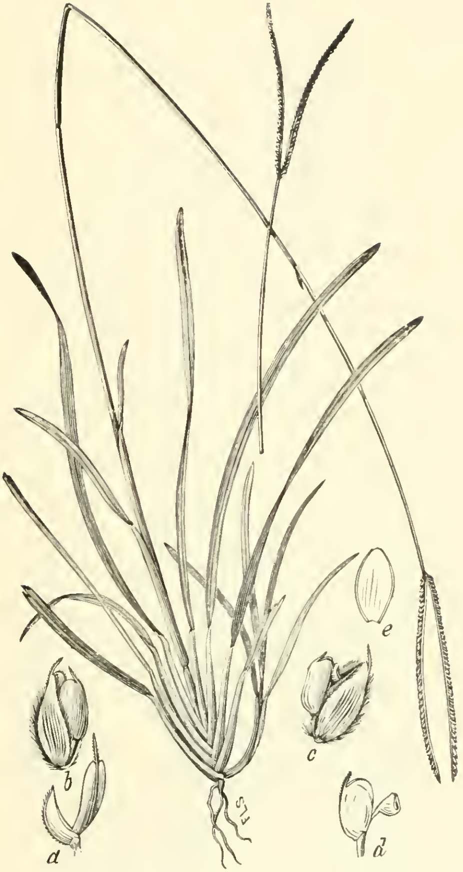


FIG. 183. **Chloris floridana** (Chapm.) Vasey (*Eustachys floridana* Chapm.); Beal, Grasses N. Am., **2** : 407.—A smooth, rather slender perennial 3 to 6 dm. high, with compressed culms and sheaths, flat leaves and one or two spikes 6 to 8 cm. long. The spikes in this and in *C. neglecta* are stouter than in *C. petræa*.—Dry, sandy soil, Florida. July–October.

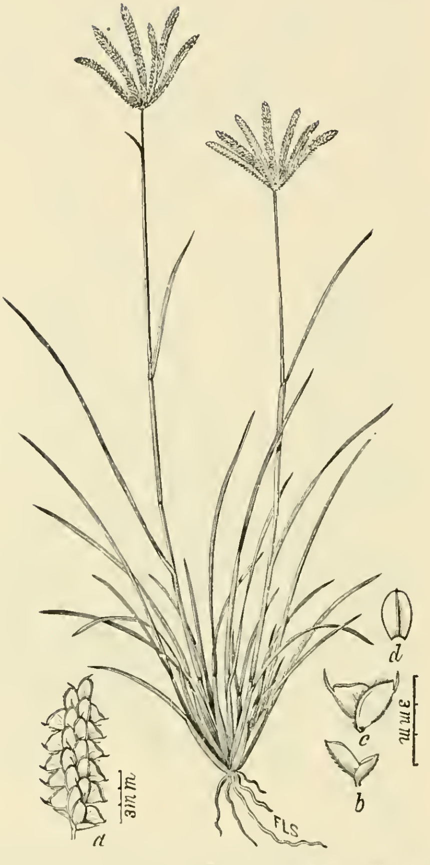


Fig. 184. **Chloris cucullata** Bisch.; Beal, Grasses N. Am., **2**: 407.—A rather slender, cæspitose perennial 2 to 4 dm. high, with narrow, flat leaves and eight to twelve spikes digitate or umbellate at the apex of the culms. Uppermost glumes cucullate.—Sandy plains, Texas to Arkansas. March–September.

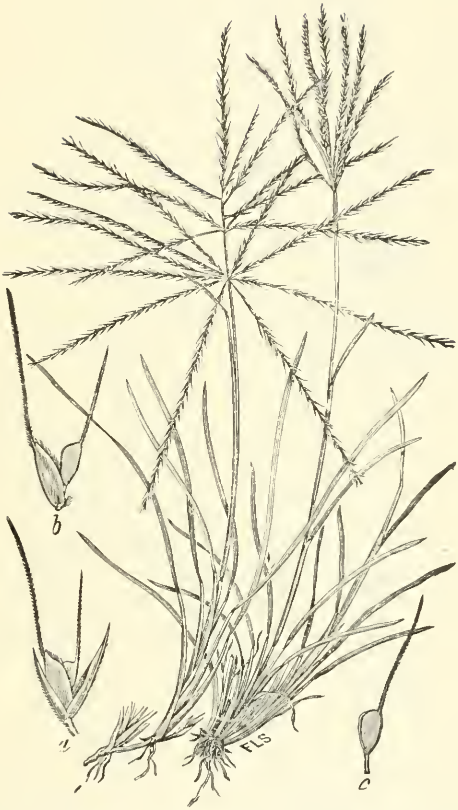


Fig. 185. **Chloris verticillata** Nutt. Windmill-grass.—A low, spreading perennial, with rather stout, upright flowering branches 1.5 to 5 dm. high and numerous widely spreading, slender spikes 8 to 13 cm. long.—Prairies, Kansas to Texas. A good turf former. May–September.

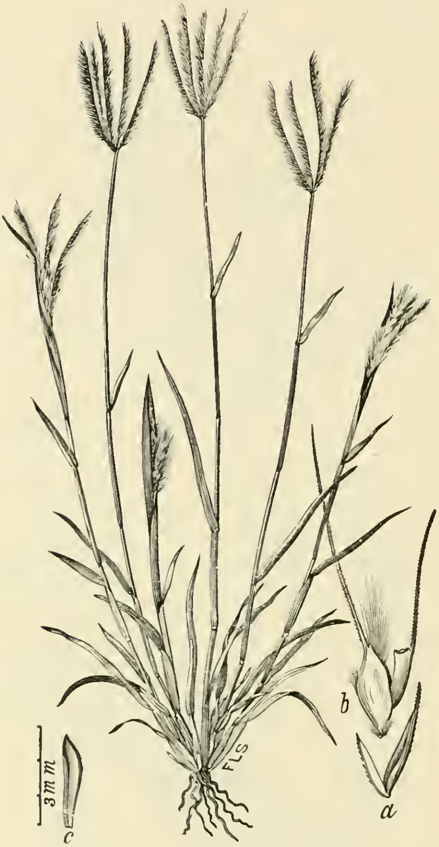


FIG. 186. **Chloris elegans** HBK. (*C. alba* Presl); Beal, Grasses N. Am., **2** : 403.—An erect perennial 3 to 6 dm. high, with slightly inflated sheaths, flat leaves and eight to twelve silky-bearded spikes, clustered or umbellate at the apex of the culms.—Dry mesas and desert hills of western Texas, southern Arizona, New Mexico, southern California and southward. An ornamental grass. June–November.

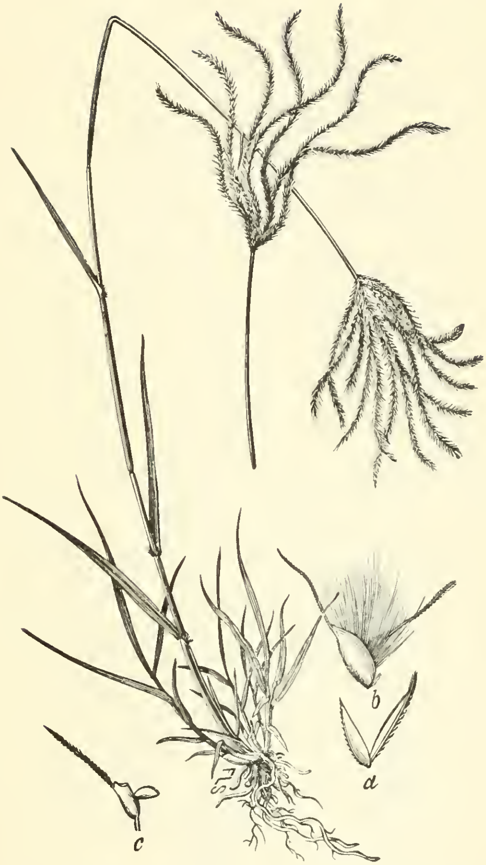


FIG. 187. **Chloris polydactyla** (L.) Sw. (*Andropogon polydactylon* L.). MANY-SPIKED CHLORIS.—A rather stout, leafy perennial about 6 dm. high, with numerous, more or less flexuose, brownish spikes 8 to 13 cm. long.—Florida. [West Indies and South America.]

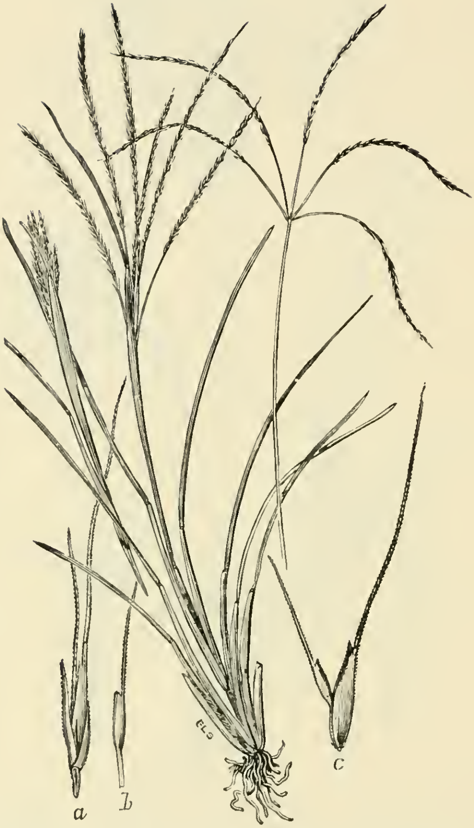


FIG. 188. **Chloris texensis** Nash in Bull. Torr. Bot. Club, **23**: 151.—A smooth, glaucous perennial 3 to 6 dm. high, the crowded lower sheaths compressed, with flat leaves and five to eight slender, terminal, digitate spikes 10 to 18 cm. long.—Texas. [Mexico?.]

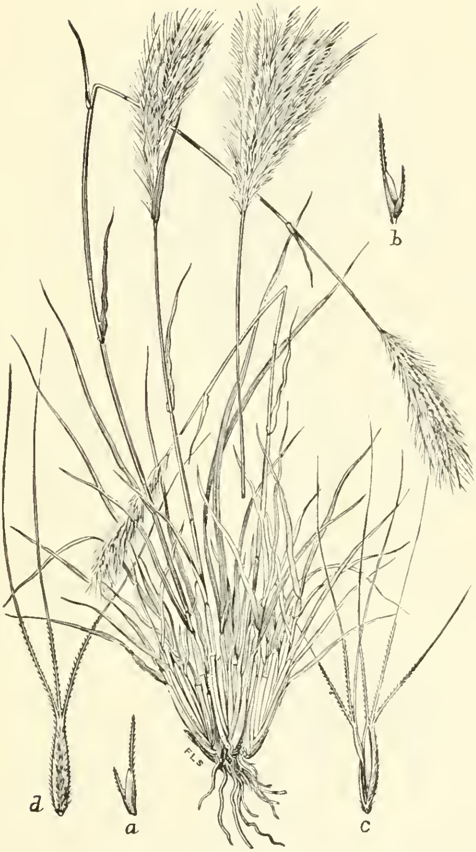


Fig. 189. **Trichloris blanchardiana** Scribn. (*T. fasciculata* Fourn.).—A rather stout perennial 5 to 10 dm. high, with long, narrow leaves and many, slender, bearded spikes, which are fasciculate or subdigitate at the apex of the culm.—Dry plains and mesas, Texas to Arizona. May–September.

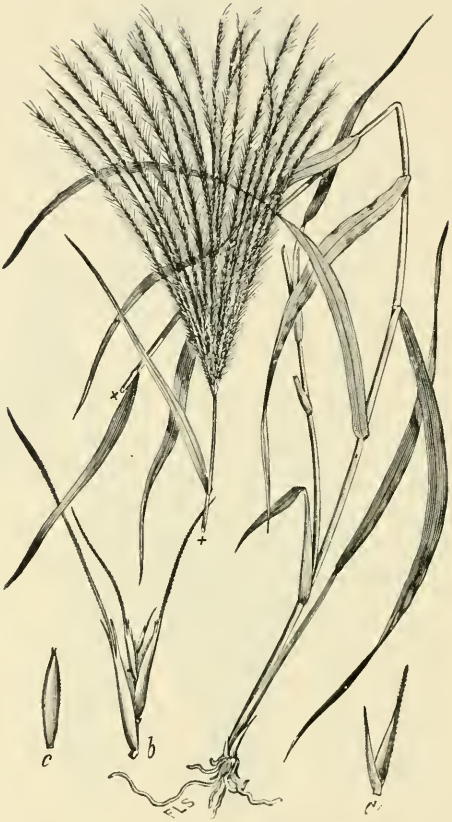


FIG. 190. **Trichloris pluriflora** Fourn. MANY-FLOWERED TRICHLORIS.—A glaucous, erect perennial 6 to 12 dm. high, with long, flat leaves and numerous erect, many-flowered, bearded spikes 8 to 15 cm. long. Spikelets three- to four-flowered.—Southern and western Texas. [Mexico.] May–July.

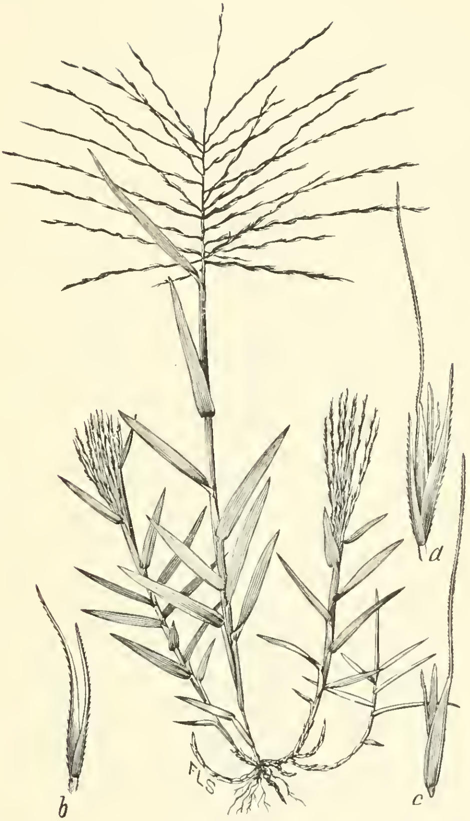


FIG. 191. **Gymnopogon ambiguus** (Michx.) B. S. P.; Britton and Brown, Ill. Fl., **1**: 178 (*G. racemosus* Beauv.). NAKED BEARD-GRASS.—A loosely tufted, erect or ascending perennial 30 to 45 cm. high, with short and broad leaf blades and numerous (fifteen to thirty). slender and widely spreading spikes irregularly scattered along the common rachis.—Dry soil, fields, hillsides, and borders of woods, New Jersey to Missouri, Indian Territory, Texas, and Florida. July–October.

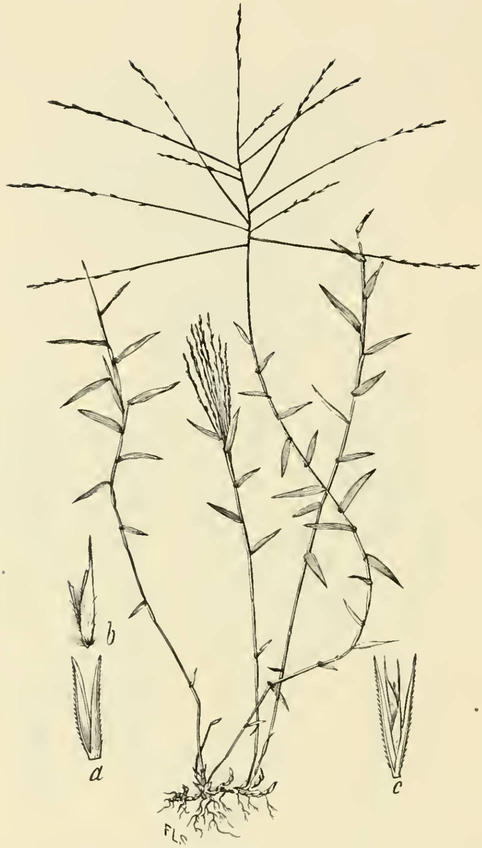


FIG. 192. **Gymnopogon brevifolius** Trin. SHORT-LEAFED BEARD-GRASS.—A slender, loosely tufted and many-jointed perennial, with erect or ascending culms 3 to 6 dm. high, short, flat leaves and numerous very slender spikes, which are naked toward the base.—Dry or moist pine barrens near the coast, New Jersey to Mississippi. August–November.

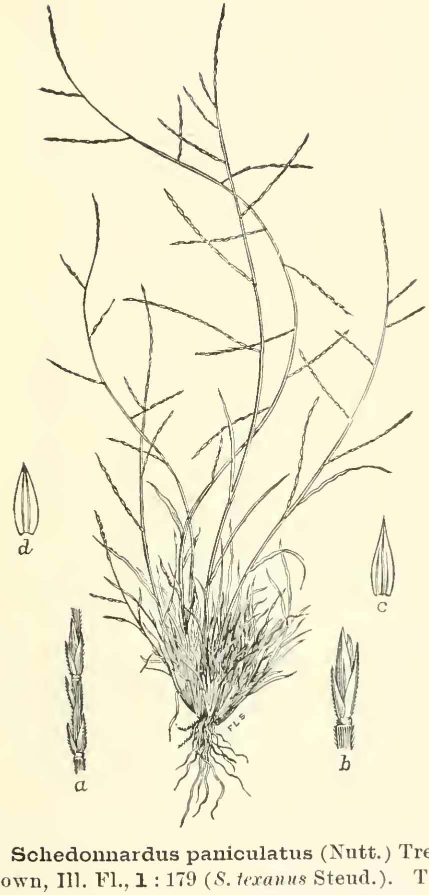


Fig. 193. **Schedonnardus paniculatus** (Nutt.) Trelease; Britton and Brown, Ill. Fl., **1** : 179 (*S. texanus* Steud.). Texan Crab-grass.—A low, diffusely branching annual, with short, narrow leaves and slender, paniculate spikes. The tufted stems vary from 1 to 9 dm. long.—Dry prairies, Illinois to Texas and New Mexico, north to Assiniboia and Manitoba. April–October.

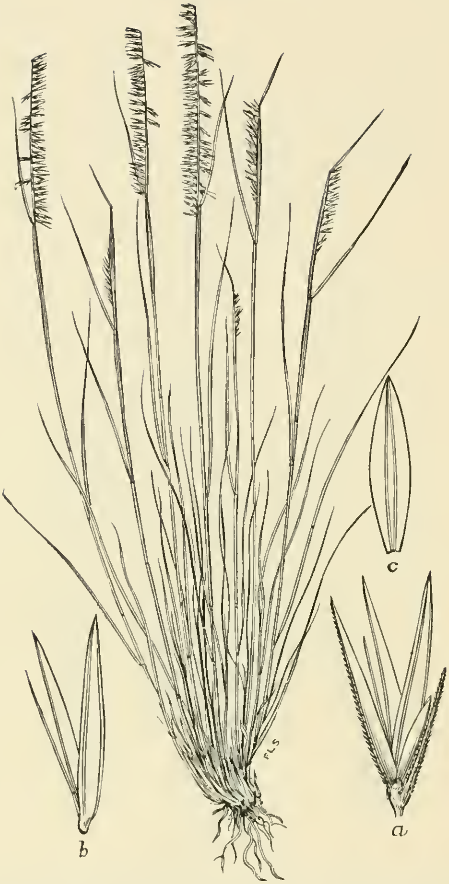


Fig. 194. **Bouteloua uniflora** Vasey; Beal, Grasses N. Am., **2**: 426. One-flowered Grama.—A slender, erect perennial 3 to 4.5 dm. high, with narrow, long-attenuate-pointed leaves and numerous (twenty-five to seventy-five), spreading or deflexed one-flowered spikes approximate along the common axis.—Southwestern Texas. September.

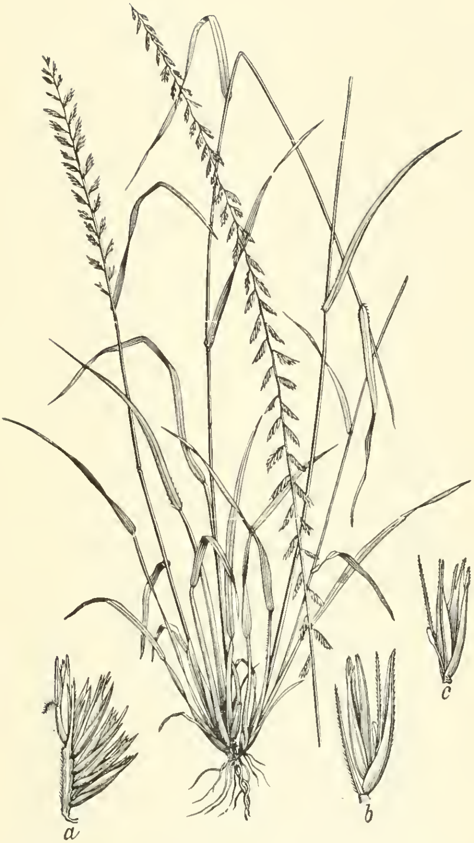


FIG. 195. **Bouteloua curtipendula** (Michx.) Torr. (*B. racemosa* Lag.). TALL GRAMA or SIDE OATS.—A densely tufted perennial 3 to 9 dm. high, with numerous (twenty to sixty), usually spreading or reflexed spikes scattered along the common axis, forming a long, somewhat one-sided raceme 20 to 40 cm. long.—Dry fields, hillsides, and prairies, New York and Ontario to New Jersey, Mississippi, Texas, California, and Manitoba. [Mexico and Central and South America.] May–October.

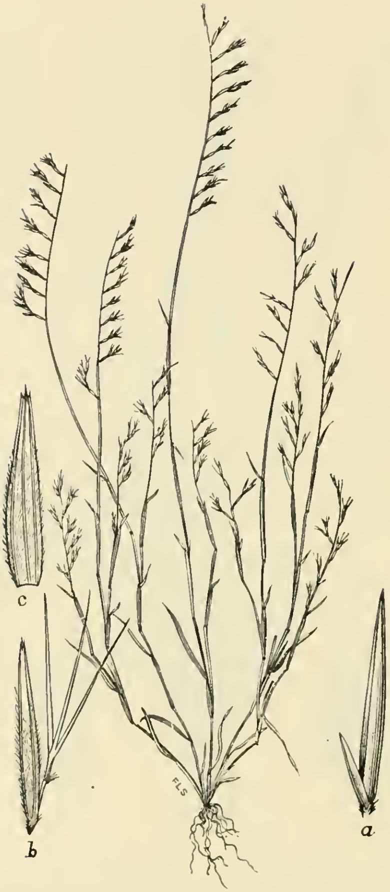


FIG. 196. **Bouteloua aristidoides** Thurb.; Beal, Grasses N. Am., **2**: 425. SIX-WEEKS MESQUIT.—A slender, densly tufted and much branched annual (?) 1 to 3.5 dm. high, with short, narrow leaves, and three to twelve very narrow and few- (sometimes only one-) flowered spikes.—Texas to southern California. [Mexico and Lower California.] August, September.

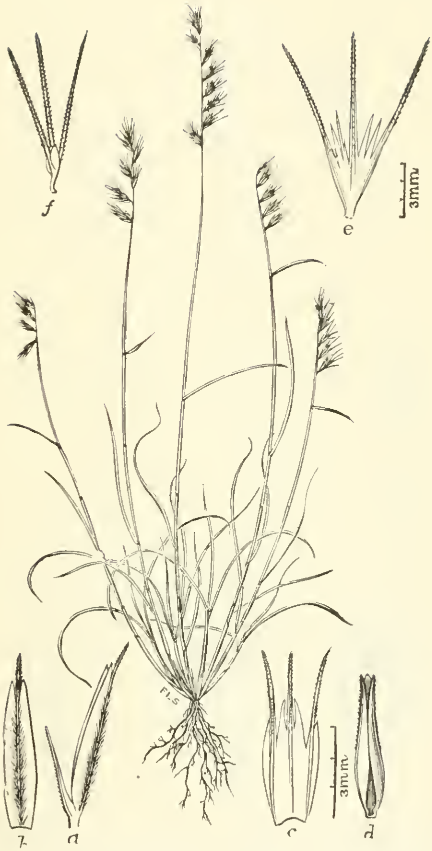


FIG. 197. **Bouteloua texana** S. Wats.; Beal, Grasses N. Am., **2**: 126. SEED MESQUITE.—A densely cæspitose, usually glabrous perennial 2 to 3 dm. high, with narrow, flat leaves, and two to ten short, many-awned spikes, approximate on the common rachis.—Dry soil, Texas and Indian Territory to Arkansas. March, April.

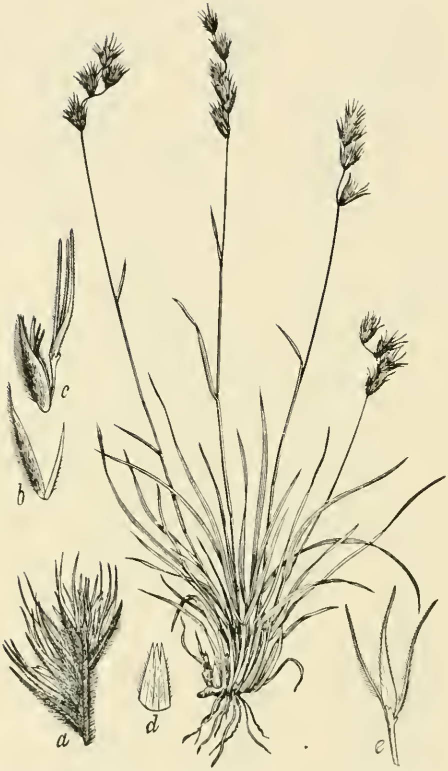


FIG. 198. **Bouteloua havardi** Vasey; Beal, Grasses N. Am. **2**: 424. HAVARD'S GRAMA.—A perennial, with strong rhizomes, upright culms 2 to 4 dm. high, and four to six short, silky-villous spikes approximate on the common rachis.—Sandy plains, rocky hills, canyons, about springs, etc., Texas to Arizona. [Northern Mexico.] April–September.

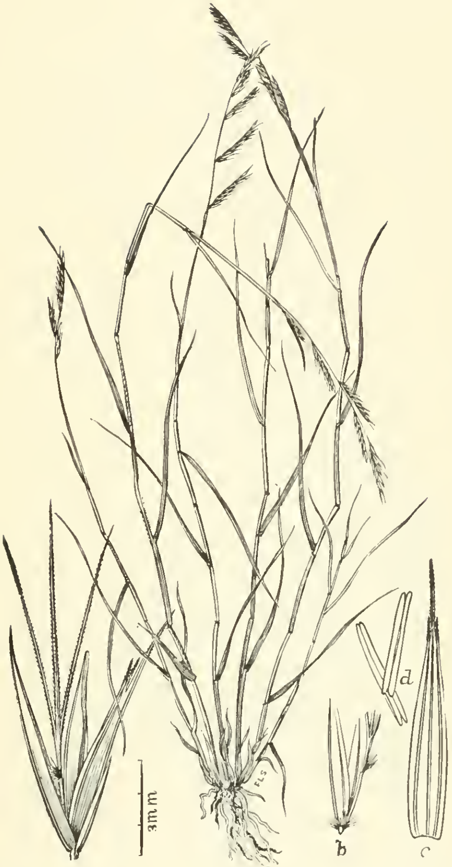


FIG. 199. **Bouteloua eriopoda** Torr.; Beal, Grasses N. Am., **2**: 421. WOOLLY-JOINTED GRAMA.—A slender, branching, and somewhat wiry perennial with wooly-jointed stems 2 to 3.5 dm. long, with three to six slender, spreading, and rather loosely flowered spikes 1.5 to 2.5 cm. long.—Dry, gravelly soil, Texas to Arizona. [Northern Mexico.] August, September.

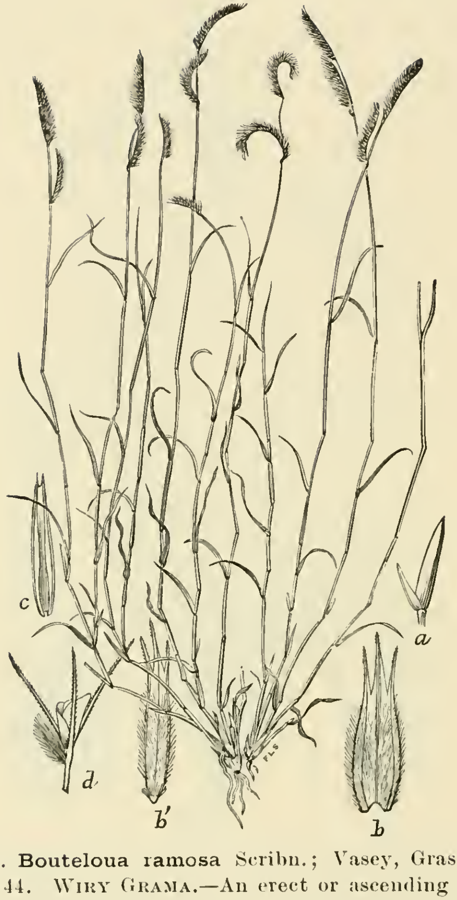


Fig. 200. **Bouteloua ramosa** Scribn.; Vasey, Grasses of the S. W., **1**: 44. Wiry Grama.—An erect or ascending perennial, with branching and many-jointed culms 3 to 4.5 dm. high, short, narrow, spreading leaves, and one to three spreading and more or less arcuate spikes 1 to 3 cm. long.—In canyons, mountains of southwestern Texas. [Northern Mexico.] August, September.

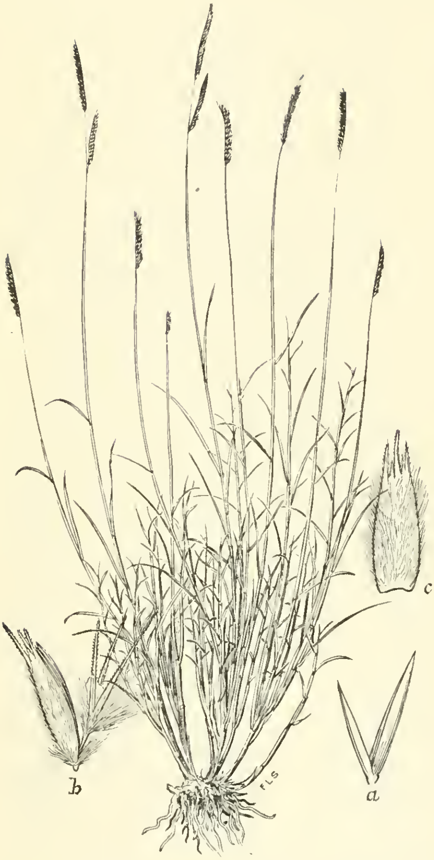


FIG. 201. **Bouteloua breviseta** Vasey; Beal, Grasses N. Am., **2**: 420. SHORT-AWNED GRAMA.—An erect, somewhat wiry and densely cæspitose perennial 2.5 to 3.5 dm. high, the lower internodes covered with a thin white bloom. Leaves very narrow, 2 to 4 cm. long. Spikes one to three, erect or somewhat divergent, about 2 cm. long.—Southwestern Texas. September.

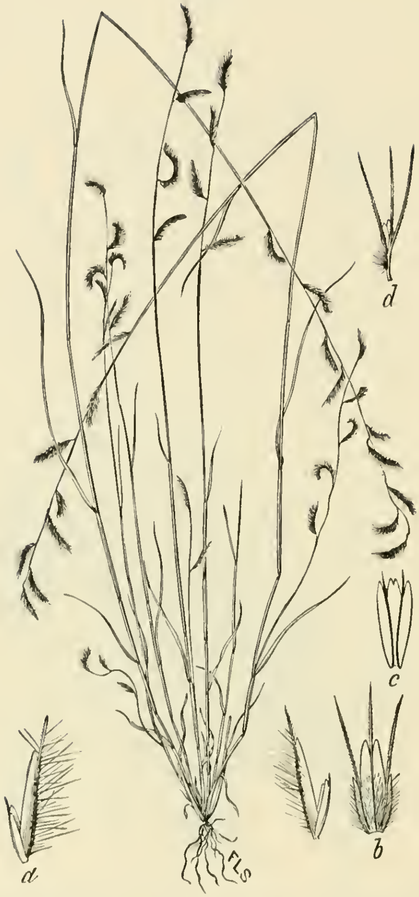


Fig. 202. **Bouteloua vestita** (S. Wats.) Scribn.; Beal, Grasses N. Am., **2**: 419. Hairy Grama.—A tufted annual, with erect or ascending slender culms 3 to 6 dm. high, with short, flat leaves and two to eight ascending, many-flowered, hairy spikes about 2 cm. long.—Sandy banks of streams and "benches" on mountain sides, western Texas to southern Arizona. [Mexico.] September, October.

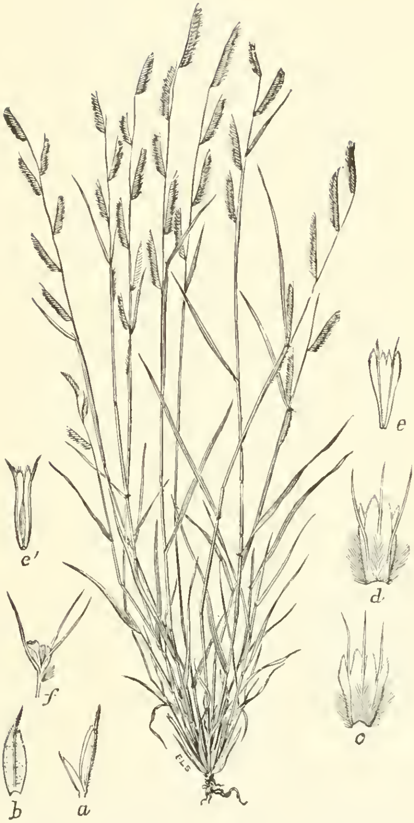


FIG. 203. **Bouteloua rothrockii** Vasey. ROTHROCK'S GRAMA.—A densely cæspitose perennial, with erect, simple or sparingly branched leafy culms 1.5 to 2 dm. high, and five to nine more or less spreading, densely flowered spikes 2 to 3 cm. long.—Sandy plains, mesas and foothills, Arizona. [Mexico.] August, September.

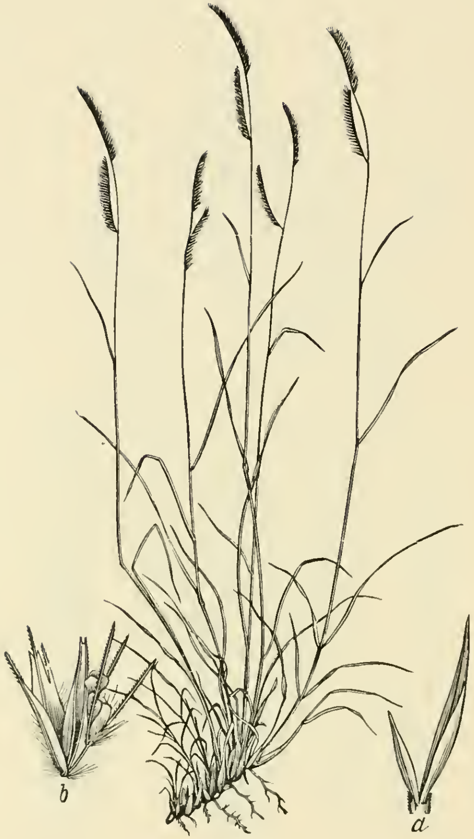


FIG. 204. **Bouteloua oligostachya** (Nutt.) Torr. BLUE GRAMA.—A slender perennial 1.5 to 5 dm. high, with one to five remote, pectinately many-flowered, usually spreading spikes 2.5 to 5 cm. long.—Wisconsin to Montana, north to Manitoba and Alberta, south to Texas, Arizona, and southern California; also at Tampa, Fla. [Mexico.] June–October.

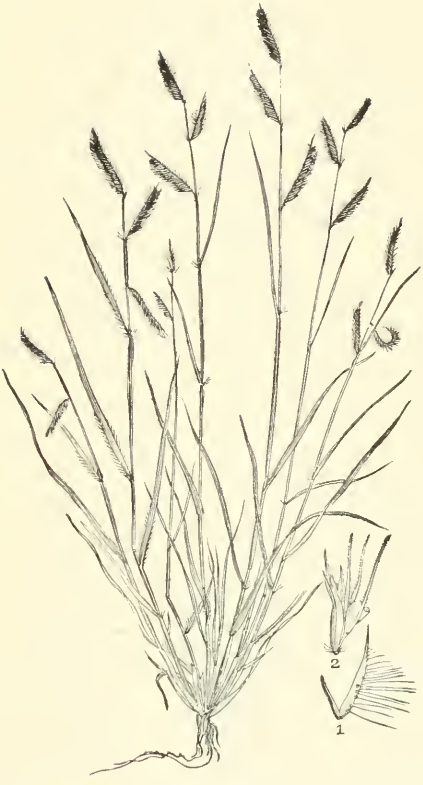


FIG. 205. **Bouteloua hirsuta** (HBK.) Lag. BRISTLY MESQUIT.—A cæspitose perennial 1.5 to 4 dm. high, with erect or ascending culms, flat leaves, and one to three more or less spreading, densely flowered spikes 2 to 4 cm. long.—Dry prairies and sandy plains, Illinois and Wisconsin to South Dakota, Nevada, Arizona, and Texas, and (?) southern Florida. [Mexico and Lower California.] July–September.

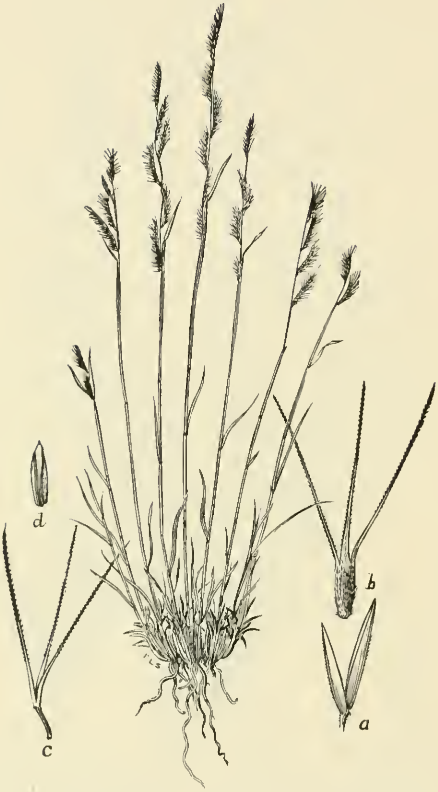


Fig. 206. **Bouteloua trifida** Thurb.; Beal, Grasses N. Am., **2**: 421. Small Grama.—A delicate perennial 1 to 3 dm. high, with short, narrow leaves, and three to seven ascending spikes usually about 2 cm. long.—Mesas and sandy plains, Texas to Arizona. [Northern Mexico.] May–October.

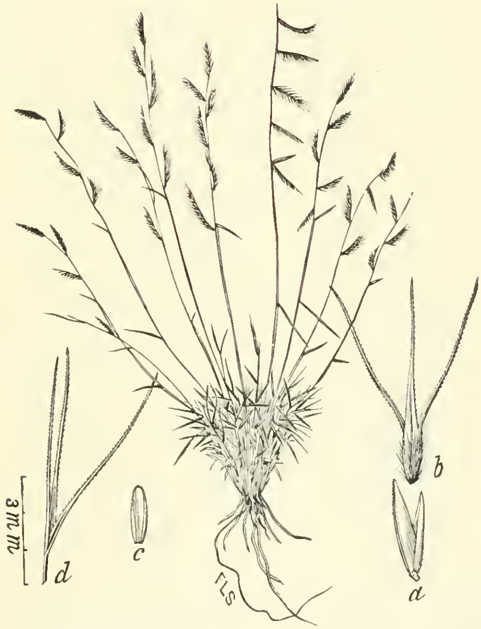


FIG. 207. **Bouteloua burkii** Scribn.; Beal, Grasses N. Am., **2**: 422. BURK'S GRAMA.—A slender, tufted perennial 15 (rarely 30) cm. high, with short, spreading leaves and slender, horizontal spikes 1 to 2 cm. long.—Sandy plains and dry mesas, western Texas. [Northern Mexico.] April–July.

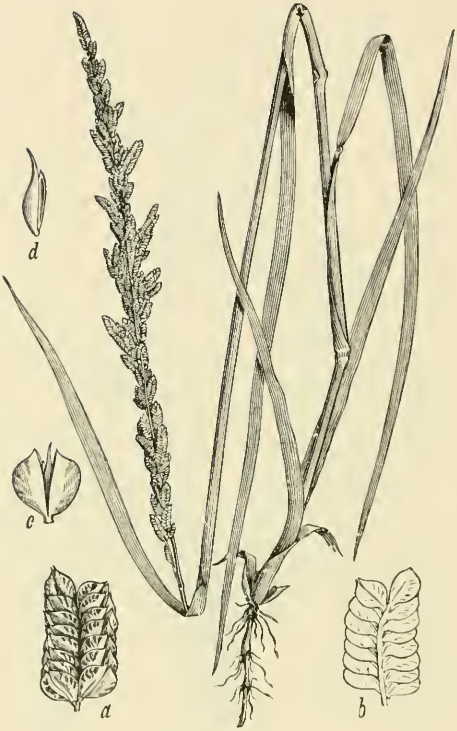


FIG. 208. **Beckmannia erucæformis** (L.) Host (*Phalaris erucæformis* Linn.). SLOUGH-GRASS.—A stout, erect, subaquatic perennial 3 to 12 dm. high, with narrow panicles composed of many, densely flowered one-sided spikes.—In sloughs and along the banks of rivers and streams, western Ontario to Iowa, California, British Columbia, and Alaska. [Europe and Asia.] June–September.

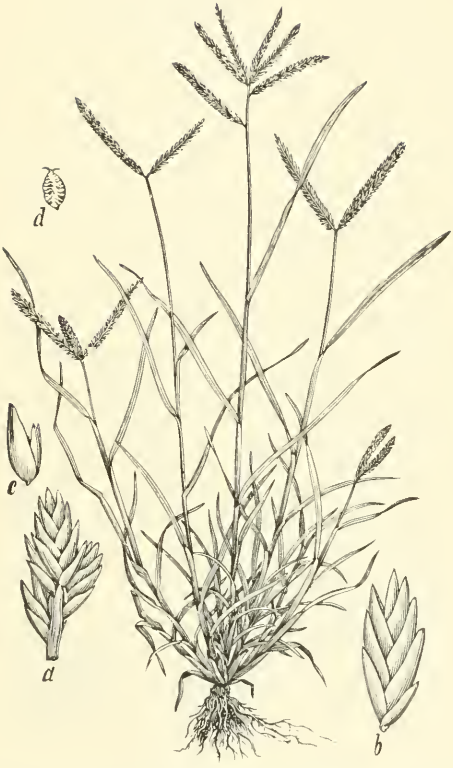


Fig. 209. **Eleusine indica (L.)** Gaertn. Goose or Yard-grass.—A coarse, tufted annual, with erect or spreading stems 1.5 to 6 dm. high, and two to five digitate spikes 5 to 7 cm. long.—Waste or cultivated ground, New Jersey to Ohio and Kansas, south to Florida and Texas. [Widely distributed in tropical and subtropical countries.] June–October.

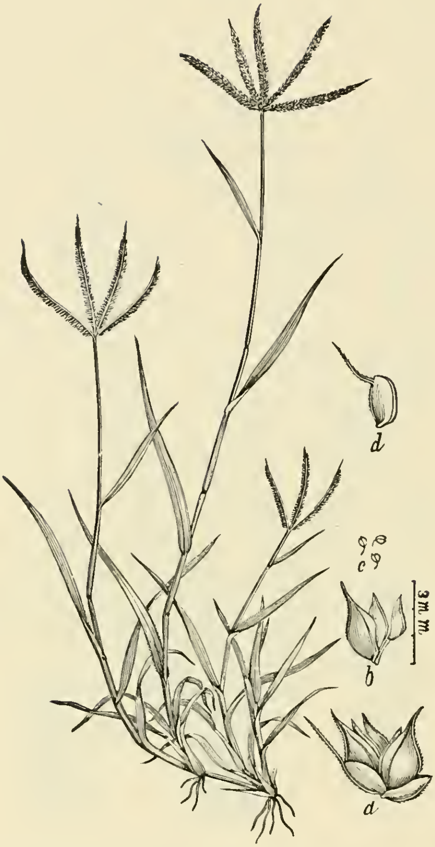


FIG. 210. **Dactyloctenium ægyptium** (L.) Willd. (*Cynosurus ægyptius* L.; *Dactyloctenium ægyptiacum* Willd.). CROWFOOT-GRASS.—A low, tufted or creeping grass, with ascending flowering stems rarely 3 dm. high, and three to five digitate spikes 2 to 5 cm. long.—Waste or cultivated ground, southern New York to Illinois, south to Florida and Texas, west to California. [Widely distributed in tropical and subtropical regions of both hemispheres.] May–December.

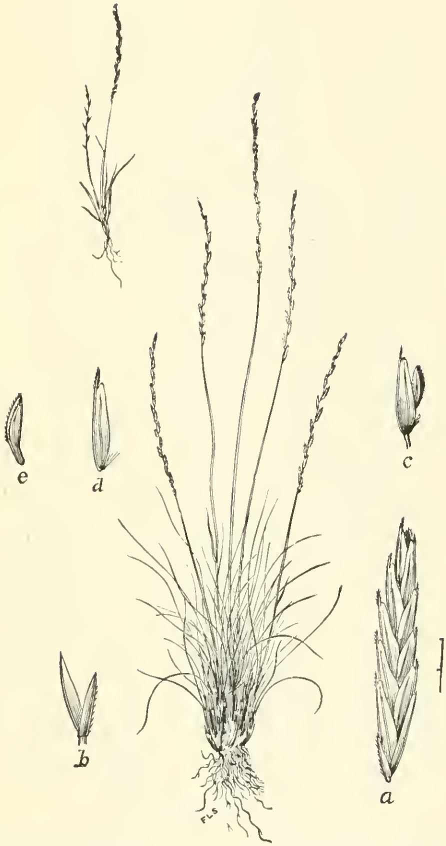


FIG. 211. **Leptochloa spicata** (Nees) Scribn. (*Bromus spicatus* Nees; *Diplachne spicata* Doell; *D. reverchoni* Vasey); Beal, Grasses N. Am., **2**: 434.—A low, densely cæspitose perennial (?), with numerous setaceous basal leaves and a slender, scape-like culm 6 to 15 cm. high.—Granitic rocks, central Texas. [Mexico and Brazil.] May–July.

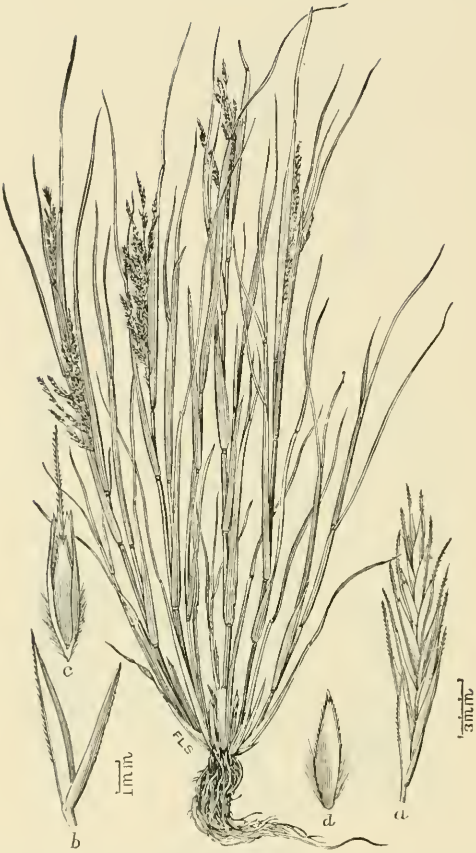


FIG. 212. **Leptochloa fascicularis** (Lam.) A. Gray. CLUSTERED SALT-GRASS.—An erect, ascending or more or less diffusely spreading, cæspitose, much-branched annual 5 to 6 dm. high, with numerous, erect, crowded spikes 6 to 8 cm. long.—Salt marshes along the coast, Rhode Island to Texas; saline soil in the interior, western New York to South Dakota, Nevada, New Mexico, and Texas. [Mexico and West Indies.] July–September.

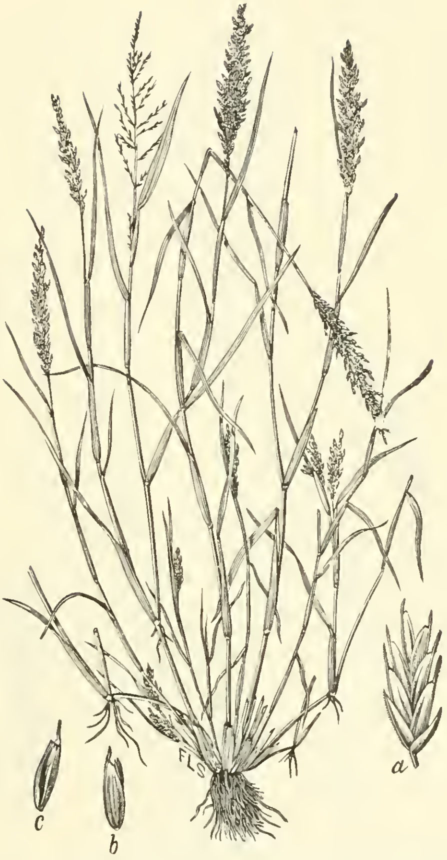


Fig. 213. **Leptochloa viscida** (Scribn.) Beal (*Diplachne viscida* Scribn.). Viscid Leptochloa.—A densely cæspitose and diffusely branched perennial (?) 0.5 to 3 (rarely 6) dm. high, with acute, flat leaves, and narrow, densely flowered panicles, composed of eight to twelve erect spikes.—Wet, clayey soil, New Mexico and Arizona. [Mexico and Lower California.] June–September.

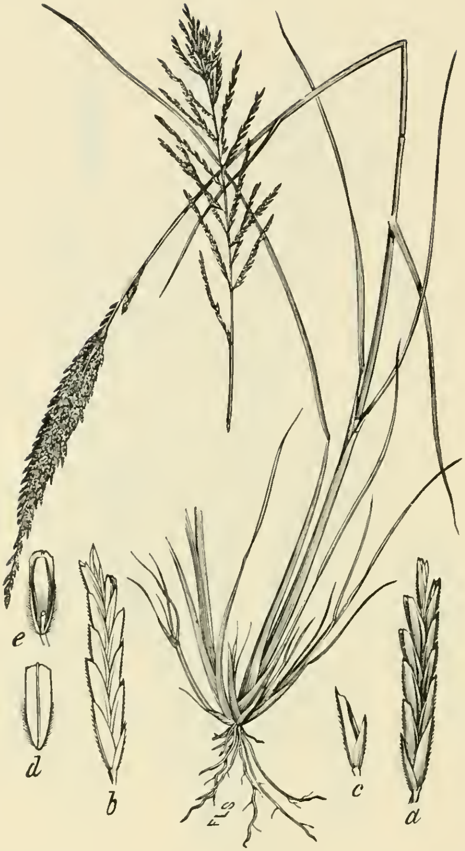


FIG. 214. **Leptochloa imbricata** Thurb. (*Diplachne imbricata* Scribn.); Beal, Grasses N. Am., **2**: 435.—A rather stout, erect or ascending perennial 3 to 9 dm. high, with smooth, usually glaucous culms, narrow, flat leaves, and numerous crowded, erect or ascending spikes 4 to 6 cm. long.—Texas to southern California. [Mexico and Lower California.] August-November.

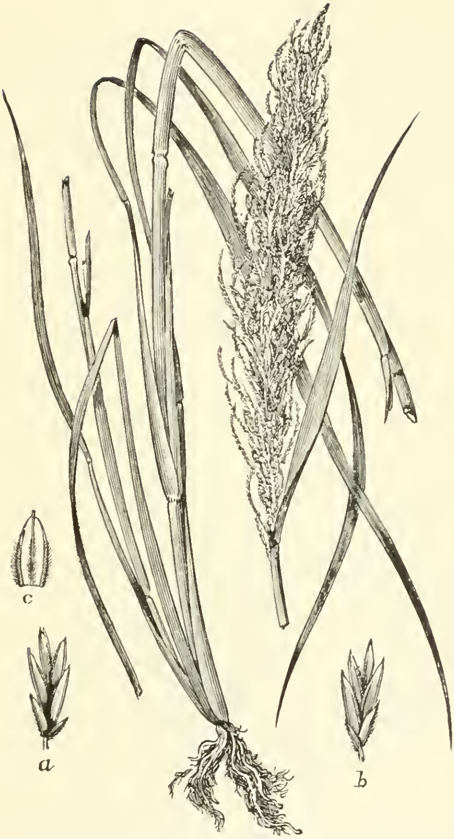


FIG. 215. **Leptochloa scabra** Nees (*L. langloisii* Vasey). ROUGH LEPTOCHLOA.—A stout annual 6 to 12 dm. high, with flat leaves and very many, crowded, slender spikes in terminal panicles 3 dm. long.—Ditches and fields, Louisiana. [Brazil.] September.

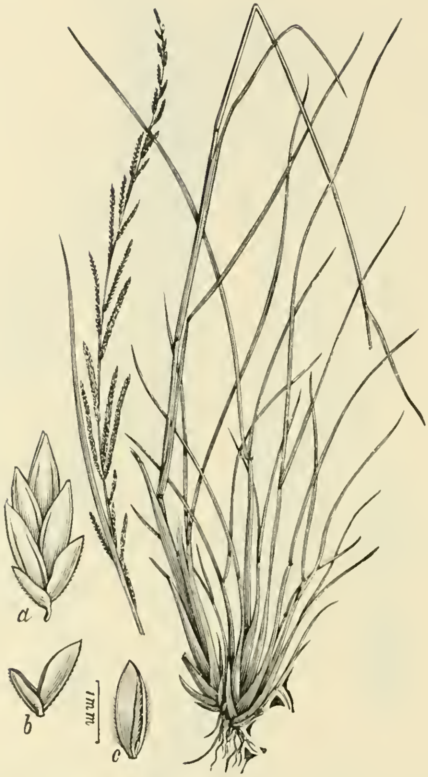


FIG. 216. **Leptochloa nealleyi** Vasey (*L. stricta* Fourn.). NEALLEY'S LEPTOCHLOA.—A slender, or rather stout perennial, with erect or ascending culms 4.5 to 12 dm. high, and narrow, elongated panicles of many erect or ascending spikes.—Western Texas. [Mexico.] April–June.

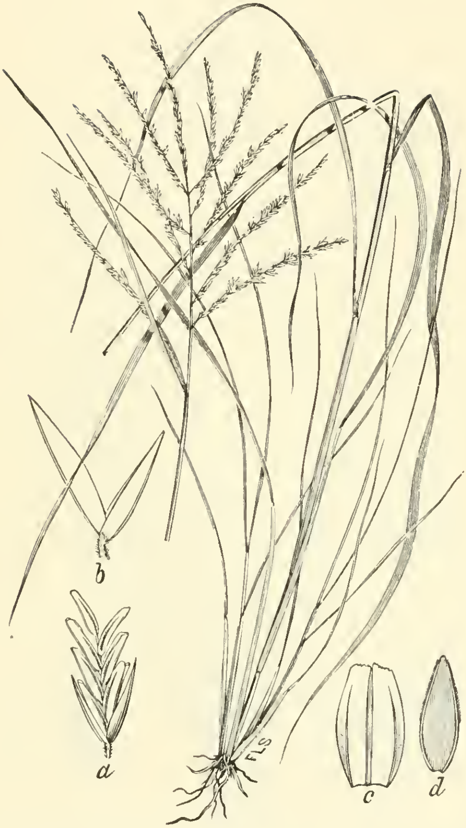


FIG. 217. **Leptochloa dubia** (HBK.) Nees (*Chloris dubia* HBK.; *Diplachne dubia* Scribn.); Beal, Grasses N. Am., **2**: 437.—A rather stout and apparently perennial species, 3 to 9 dm. high, with usually eight to ten approximate spreading spikes 6 to 8 cm. long.—Southern Florida, Texas to Arizona, and southward into Mexico. April–September.

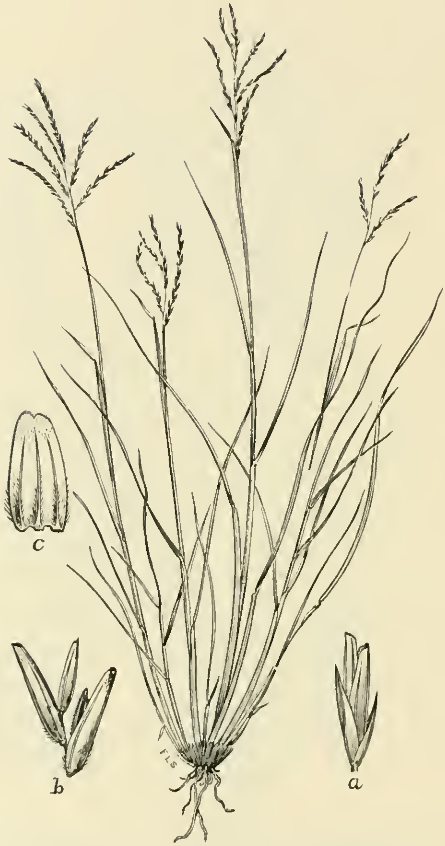


FIG. 218. **Leptochloa pringlei** (Vasey) Beal, Grasses N. Am., 2: 436.—A rather slender perennial 2.5 to 3.5 dm. high, with narrow leaves and four to six spikes 2.5 to 5 cm. long, approximate near the summit of the culm. Spikelets two- to three-flowered.—Arizona. April, May.

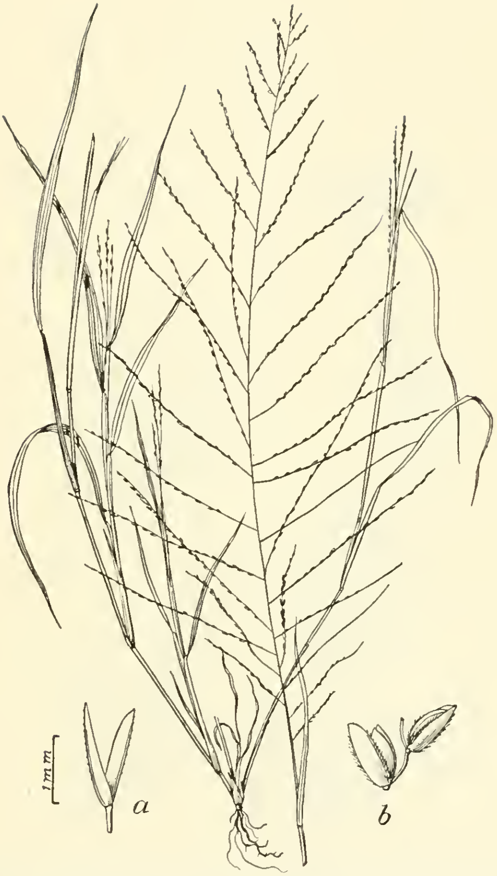


Fig. 219. **Leptochloa mucronata** (Michx.) Kunth. Feather-grass.—A more or less branching annual 6 to 12 dm. high, with rather broad, flat leaves and long terminal panicles of many slender spikes.—A weed in cultivated and waste grounds, Virginia, Illinois, Missouri, Tennessee, Alabama, Texas, Indian Territory, Arizona, and California. [Northern Mexico and Cuba.] June-October.

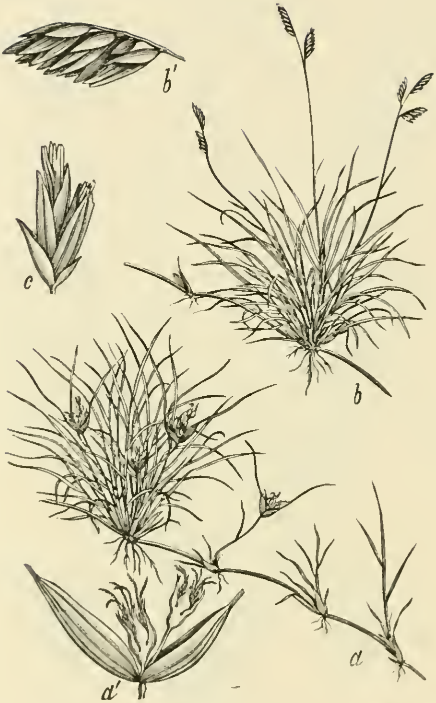


Fig. 220. **Bulbilis dactyloides** (Nutt.) Raf. (*Buchloë dactyloides* Engelm.); Britton and Brown, Ill. Fl., **1** : 183. Buffalo-grass.—A low, fine-leafed, and extensively creeping perennial, rarely more than 1 to 1.5 dm. high. Similar to Bermuda in habit of growth.—Dry prairies and river bottoms, Minnesota and South Dakota (ascends to 1,650 m. in Black Hills), to Arkansas, southern Texas, and Colorado. [Mexico.] March–August.

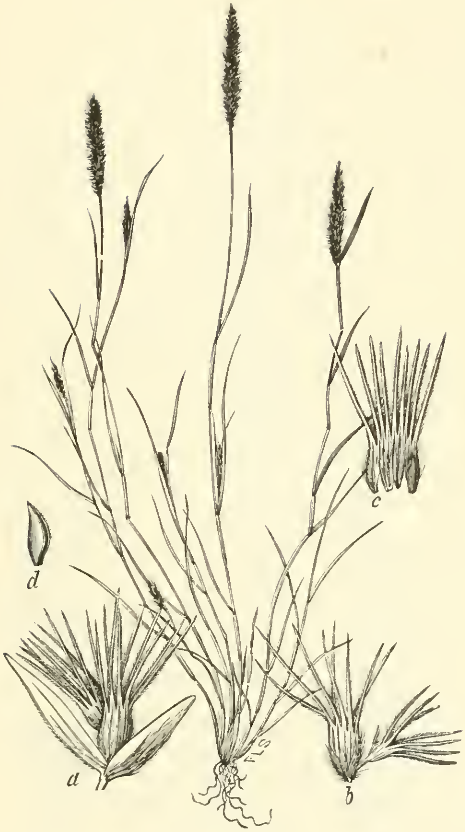


Fig. 221. **Pappophorum wrightii** S. Wats. (*P. boreale* Torr., not Griseb.); Beal, Grasses N. Am., **2**: 448. Purple-grass.—A slender, branching and apparently annual species 2 to 4 dm. high, with narrow, involute leaves and densely flowered, spike-like, lead-colored or purplish panicles 1 to 7 cm. long.—Rocky hills, canyons, and open plains, western Texas to Arizona. [Northern Mexico.] July–September.

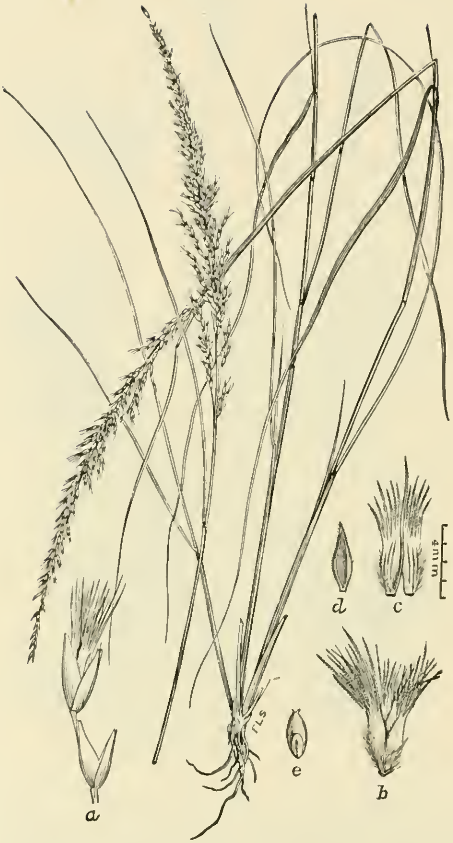


FIG. 222. **Pappophorum apertum** Scribn.; Bull. Torr. Bot. Club, **9**: 148; Beal, Grasses N. Am., **2**: 447.—A cæspitose perennial 3 to 8 dm. high, with long, narrow, mostly involute leaves and narrow, pale, or often straw-colored panicles 15 to 20 cm. long.—Valleys, western Texas to Arizona and Mexico. June.

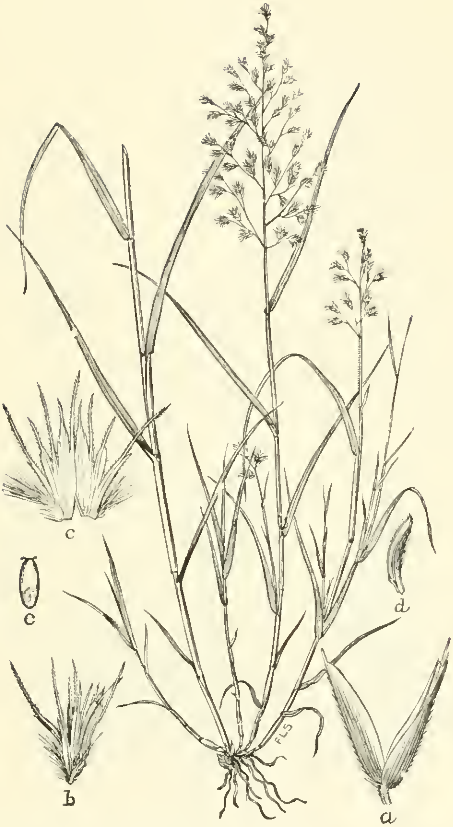


FIG. 223. **Cottea pappophoroides** Kth. COTTA-GRASS.—An erect, branching perennial 3 to 6 dm. high, with narrow, flat, pilose leaves and oblong, open panicles 9 to 18 cm. long; spikelets two- to six-flowered, floral glumes many-parted.—In canyons, western Texas to Arizona. [Mexico and South America.] August–October.

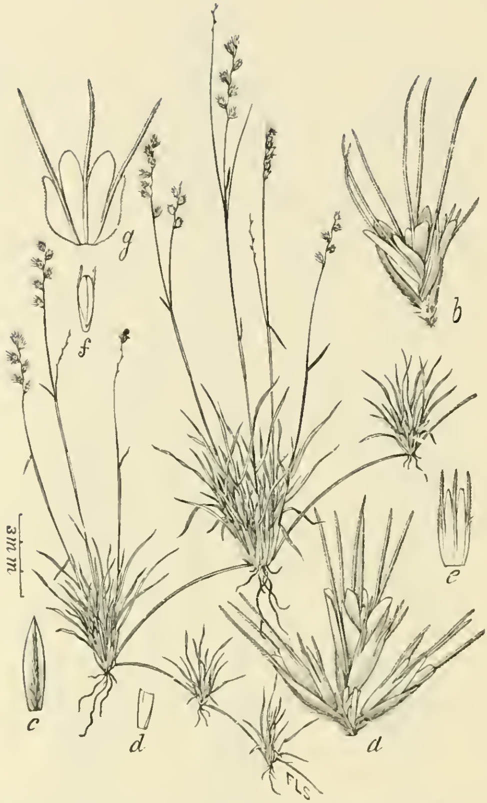


FIG. 221. **Cathestecum prostratum** Presl (*C. erectum* Vasey and Hack.); Beal, Grasses N. Am., **2** : 452.—An extensively creeping, slender perennial, with upright flowering branches 1 to 3 dm. high, narrow, flat leaves, and clustered spikelets in terminal or lateral racemes.—Dry mesas and bluffs along the Rio Grande, western Texas. [Mexico.] July–October.

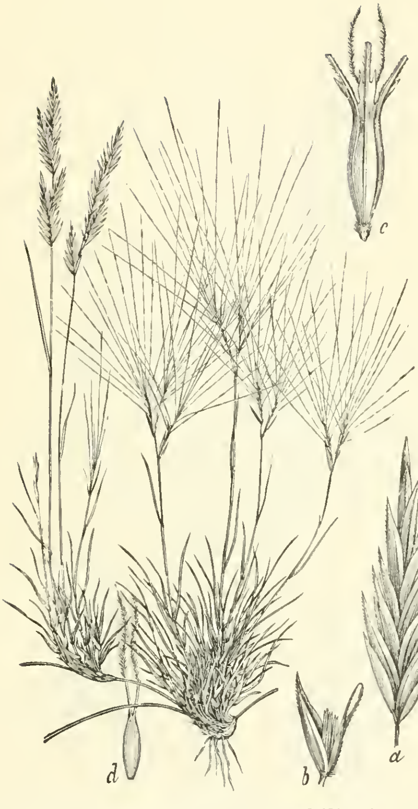


FIG. 225. **Scleropogon brevifolius** Philippi (*Tricuspis monstrosa* Munro; *Lesourdia multiflora* and *L. karwinskyana* Fourn.).—A wiry, creeping perennial with densely tufted, upright, leafy branches 1 to 2.5 cm. high, and unisexual spikelets: the pistillate long-awned, the staminate awnless.—Dry mesas and canyons, Colorado to Texas, New Mexico, Arizona, and southward into Mexico and South America. May–October.

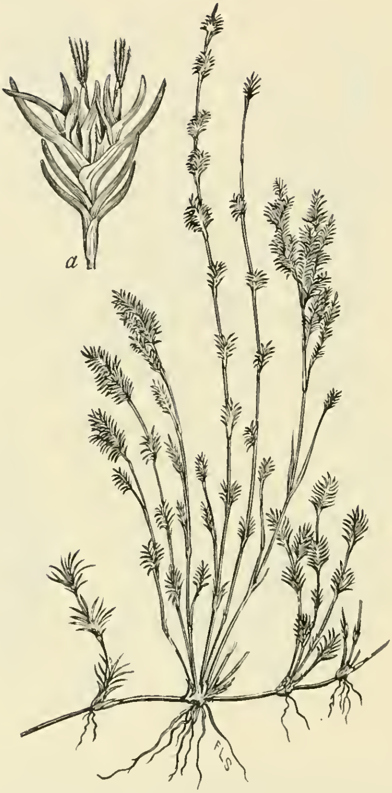


FIG. 226. **Monanthochloe littoralis** Engelm. SALT CEDAR.—A creeping grass, with hard, woody stems, and crowded, subulate, rigid leaves 2 cm. long or less.—Rocky shores and salt marshes along the coast, southern Florida, extreme southern Texas, southern California. [Lower California.] May, June.

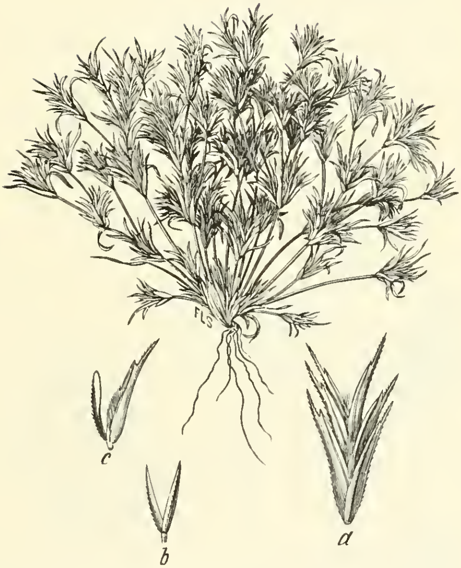


Fig. 227. **Munroa squarrosa** (Nutt.) Torr. False Buffalo-grass.—A low, diffusely much-branched annual, with crowded and sharply pointed, rigid leaves 0.5 to 2.5 cm. long.—Prairies and dry plains, South Dakota to Texas, west to Alberta, Montana, Colorado, and Arizona. June–October.

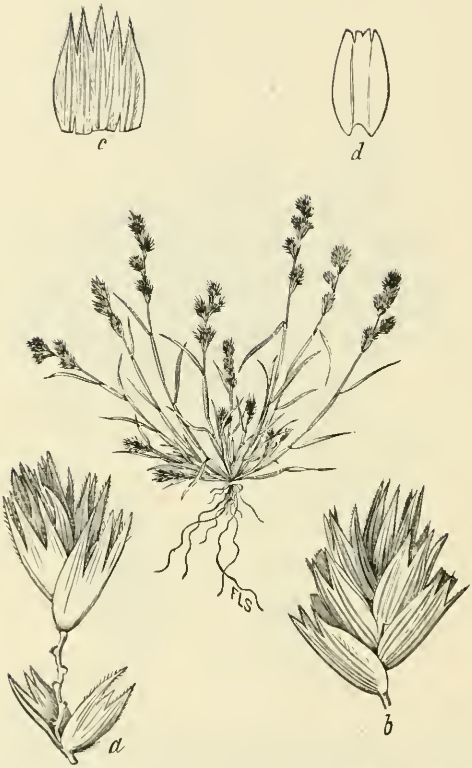


FIG. 228. **Orcuttia californica** Vasey: Beal. Grasses N. Am., **2**: 457.—A low, much-branched, cæspitose annual 0.5 to 1 dm. high, the numerous stems bearing three to six spikelets near the apex.—Southern and Lower California. April.

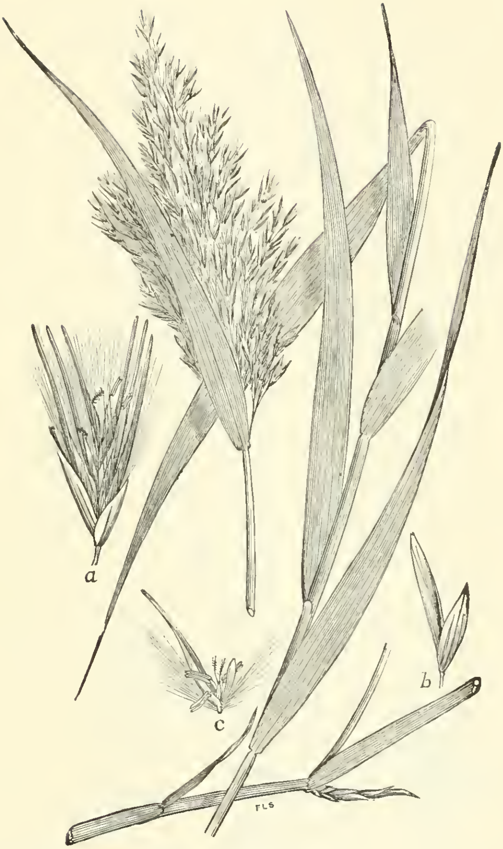


FIG. 229. **Phragmites vulgaris** (Lam.) B. S. P. (*P. communis* Trin.; *Arundo vulgaris* Lam.; *A. phragmites* L.). COMMON REED.—A tall, stout, perennial grass, with stout, creeping rootstocks, numerous broad, attenuate-pointed leaves, and a large ovoid-pyramidal, purplish, terminal panicle.—Margins of lakes and rivers and in brackish coast marshes, almost everywhere in the United States and southern British America. [Widely distributed in temperate regions of both hemispheres.] August–October.

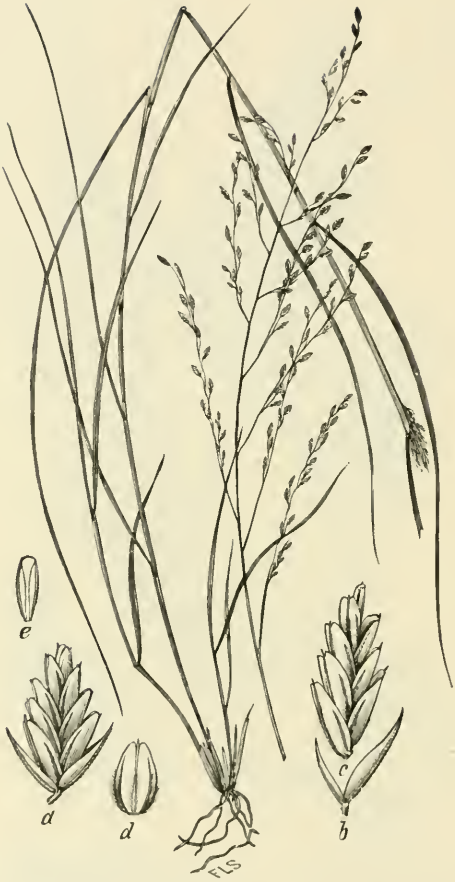


FIG. 230. **Triodia eragrostoides** Vasey & Scribn. (*Sieglingia eragrostoides* Dewey); Beal, Grasses N. Am., **2** : 465.—An erect, leafy perennial 6 to 9 dm. high, with long, narrow leaves and open, small-flowered panicles 2 to 3 dm. long.—Rocky banks, etc., southern Texas, southern Florida. [Northeastern Mexico.] June–October.

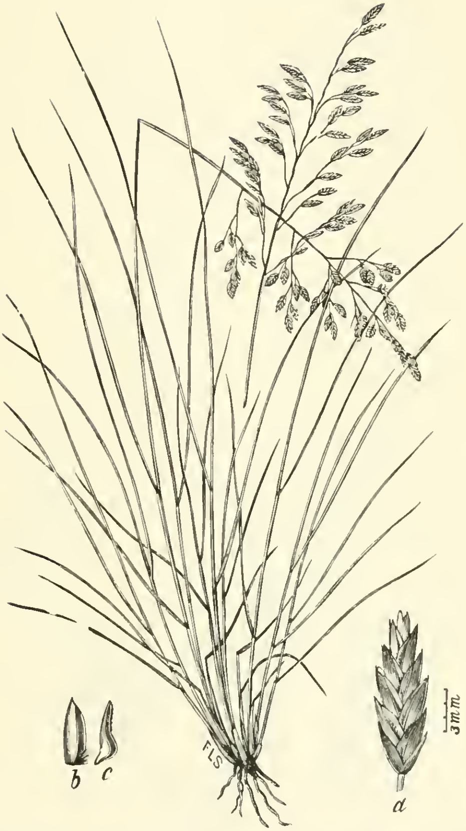


FIG. 231. **Triodia texana** S. Wats.; Beal, Grasses N. Am., **2**: 466.—A slender, wiry grass 3 to 6 dm. high, with very narrow leaves and loosely few-flowered, nodding panicles 10 to 15 cm. long.—Rich valley land, dry places, etc., Louisiana and Texas to Arizona. [Northern Mexico.] June–August.

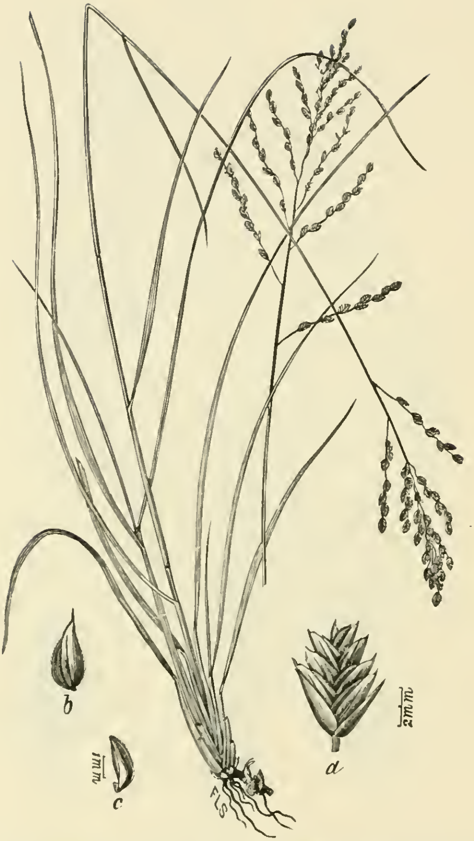


Fig. 232. **Triodia ambigua** (Ell.) Vasey; Beal, Grasses N. Am., **2**: 465, sub. *Sieglingia* (*Poa ambigua* Ell.).—An erect perennial 6 to 12 dm. high, with narrow, flat leaves and open, pyramidal panicles 10 to 20 cm. long.—Dry, open, pine barrens near the coast, South Carolina to Texas. July–October.

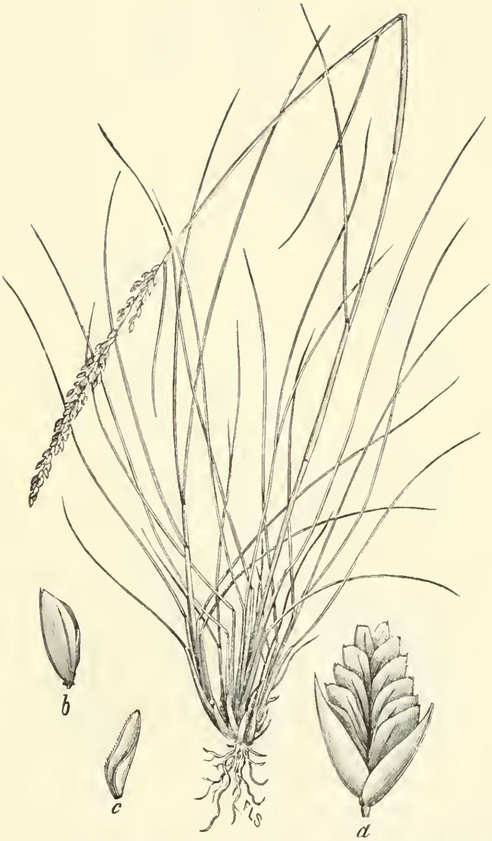


FIG. 233. **Triodia albescens** (Munro) Vasey (*Sieglingia albescens* Kuntze); Beal, Grasses N. Am., **2**: 469. WHITE TOP.—A cæspitose, erect perennial 4 to 7 dm. high, with narrow, flat leaves and densely flowered, spike-like panicles 9 to 15 cm. long.—Texas. August–October.

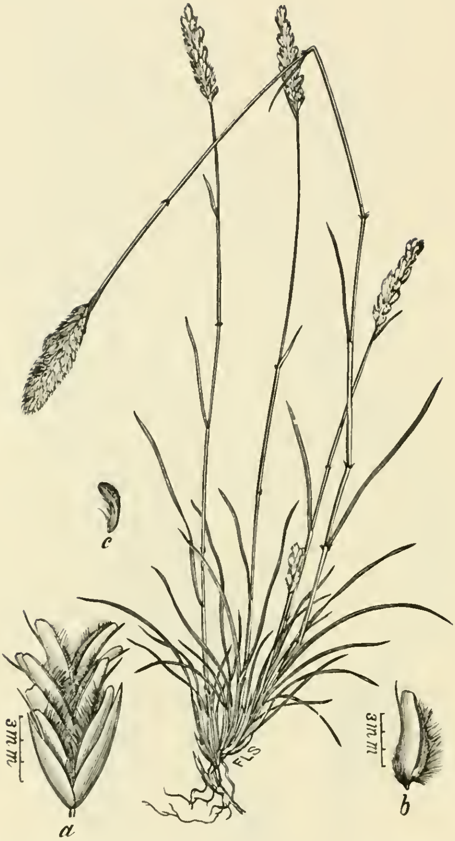


FIG. 234. **Triodia nealleyi** Vasey; Bull. Torr. Bot. Club., **15**: 49 (1888); (*Sieglingia nealleyi* Dewey; Beal, Grasses N. Am., **2**: 470).—A slender, glaucous, caespitose perennial, 3 to 4 dm. high, with flat or conduplicate leaves, and densely flowered, linear or ovoid panicles 4 to 5 cm. long.—Canyons and ridges, southwestern Texas. September.

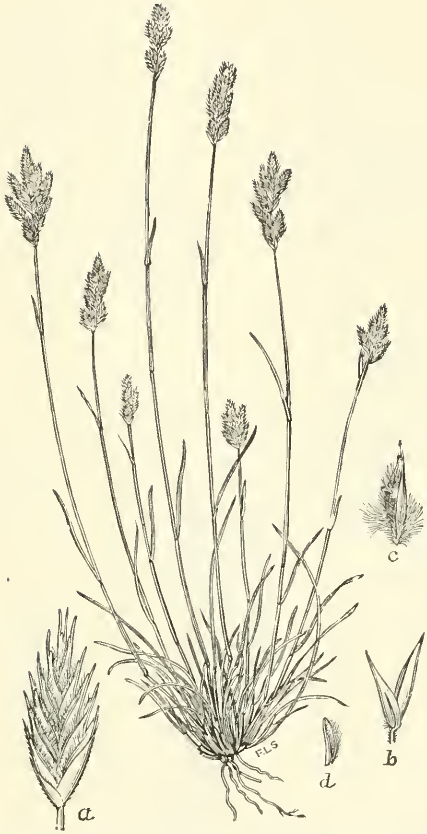


FIG. 235. **Triodia acuminata** (Munro) Vasey (*Sieglingia acuminata* Kuntze); Beal, Grasses N. Am., **2**: 470.—A slender, densely tufted perennial 1.5 to 2 dm. high, with short leaves, and simple, dense, oblong panicles 1.5 to 3 cm. long.—Poor, gravelly soil, hillsides, etc., Texas to Arizona, north to Colorado and Indian Territory. [Northern Mexico.] April–June.

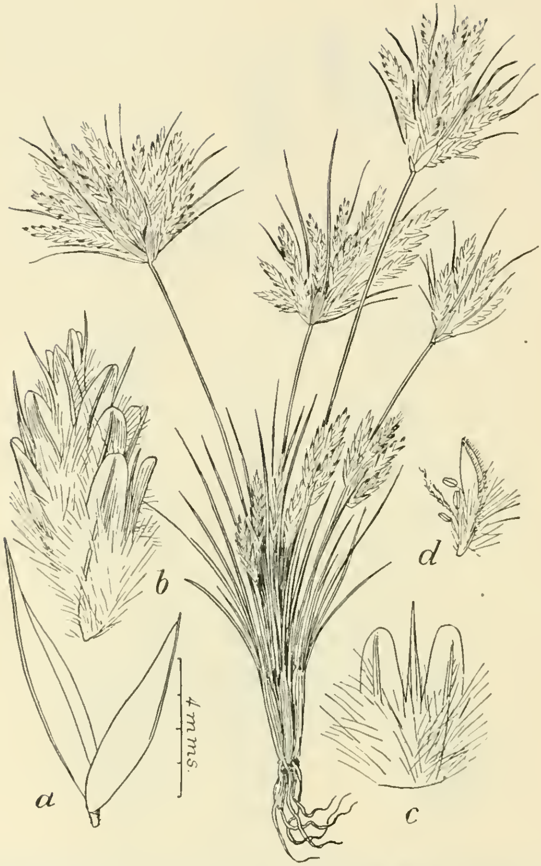


Fig. 236. **Triodia pulchella** HBK. (*Sieglingia pulchella* Kuntze); Beal, Grasses N. Am., **2**: 468.—A low, densely tufted and often creeping perennial 2 to 15 cm. high, with very narrow leaves and crowded spikelets in clusters of three to six, which are equaled or exceeded by the upper leaves.—Western Texas to Nevada and southern California. [Northern Mexico.] February–June.

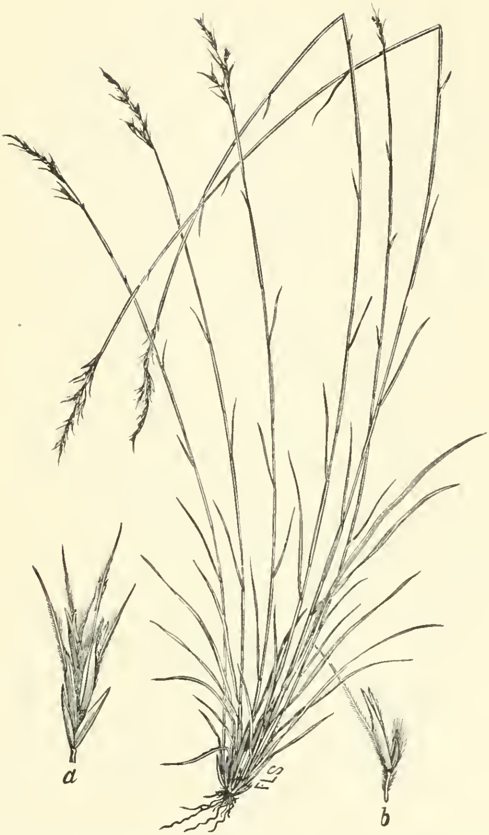


Fig. 237. **Triplasis americana** Beauv. (*Sieglingia americana* Beal, Grasses N. Am., **2** : 466).—A slender, cæspitose grass, with wiry culms 4 to 9 dm. high, rather short, narrow leaves, and few-flowered, simple panicles 3 to 10 cm. long; the pubescent awns 5 to 7 mm. long.—Dry, sandy soil near the coast, North Carolina to Mississippi. July–October.

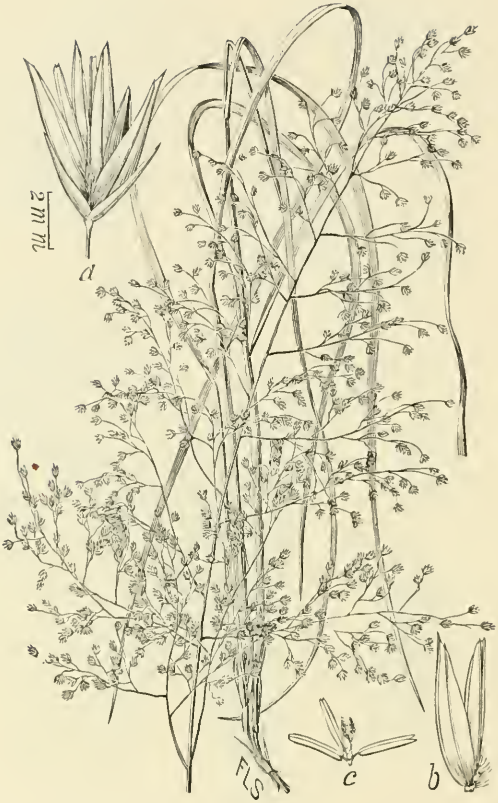


Fig. 238. **Redfieldia flexuosa** (Thurb.) Vasey (*Graphephorum* (?) *flexuosum* Thurb.); Britton and Brown, Ill. Fl., **1**: 186. REDFIELD'S-GRASS.—A stout, native perennial 6 to 12 dm. high, with very long, narrow leaves and diffuse, capillary panicles 25 to 60 cm. long.—Sand hills and "blow-outs." Kansas and Nebraska to Indian Territory, Colorado, and Wyoming. July, August.

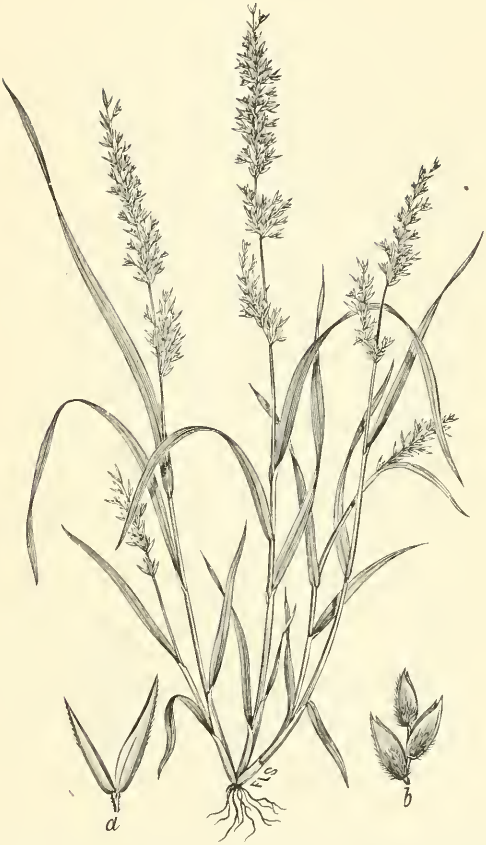


FIG. 239. **Dissanthelium californicum** (Nutt.) Benth.; Beal, Grasses N. Am., **2** : 473 (*Stenochloa californica* Nutt.).—A slender, glabrous, branching annual 1 to 3 dm. high, with short, narrow leaves and contracted, spike-like panicles 4 to 8 cm. long.—Santa Catalina Island, southern California, and Guadaloupe Islands, Lower California. September.

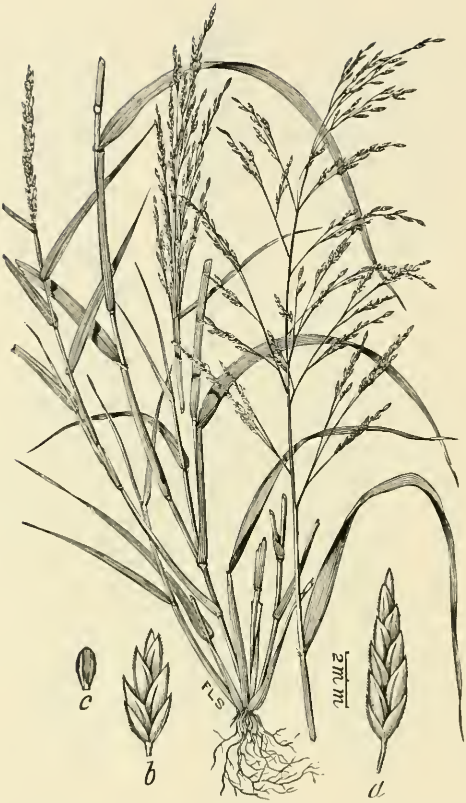


FIG. 240. **Eragrostis neo-mexicana** Vasey; Beal, Grasses N. Am., **2**: 485. CRAB-GRASS (in New Mexico).—A rather stout, branching and leafy annual 3 to 12 dm. high, with flat leaves and ample, diffuse panicles 20 to 40 cm. long.—Texas to southern California (ascends to 1,500 m. in Arizona). August. A valuable hay grass resembling Teff (*E. abyssinica*).

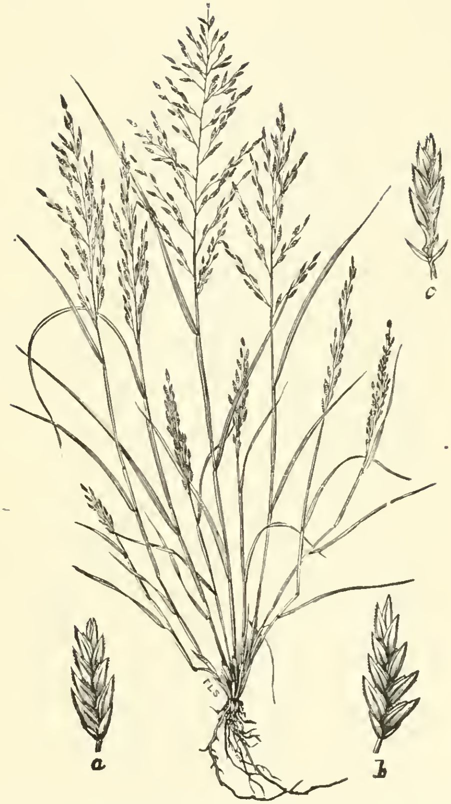


Fig. 241. **Eragrostis purshii** Schrad. Southern Spear-grass.—An annual, 1 to 4 dm. high, with the erect or ascending culms diffusely branching near the base, and diffuse panicles of small, spreading spikelets.—Sandy river banks, waste ground, etc., Massachusetts and Ontario to South Dakota and California, south to Florida, Texas, and Arizona. [Mexico.] June-October.

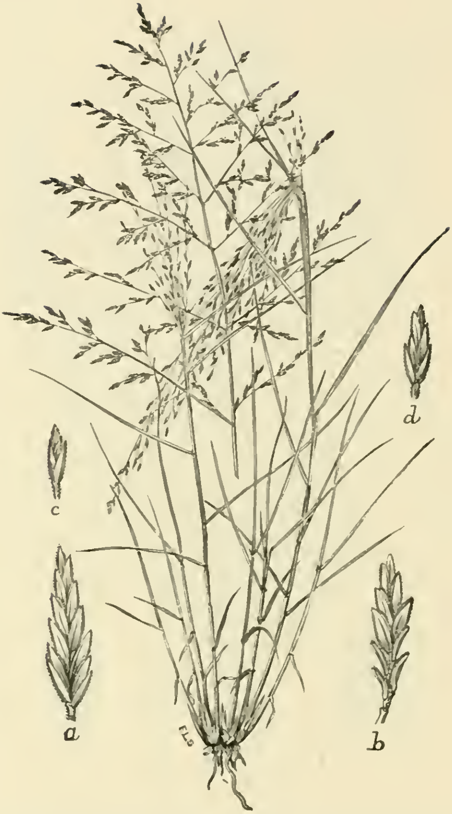


FIG. 242. **Eragrostis curtipedicellata** Buckl.; Britton and Brown, Ill. Fl., **1**: 190. SHORT-STALKED ERAGROSTIS.—A rather rigid, branching perennial 3 to 9 dm. high, with flat, spreading leaves and diffuse panicles 20 to 30 cm. long. Related to *E. pectinacea*.—Prairies, Kansas, Indian Territory, and Texas. July–September.

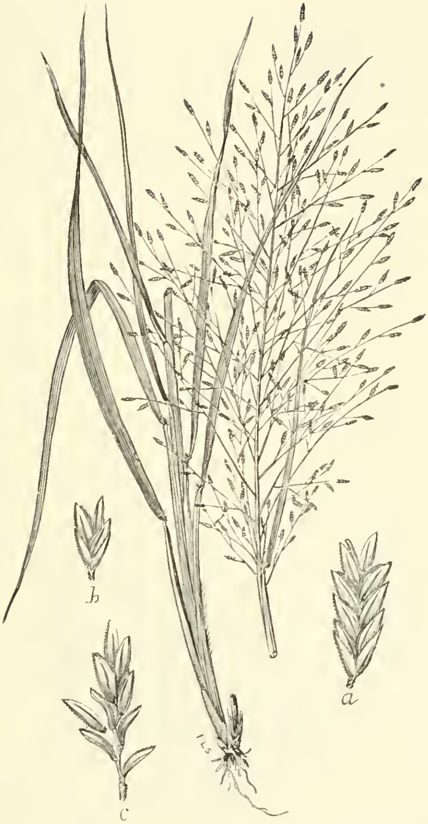


FIG. 243. **Eragrostis pectinacea** (Michx.) Steud.—An erect, cæspitose perennial 3 to 9 dm. high, with a short, stout rootstock and large, spreading, red-purple panicles.—Dry, sandy soil in the open, Massachusetts to South Dakota and Colorado, south to Florida and Texas. July–October.

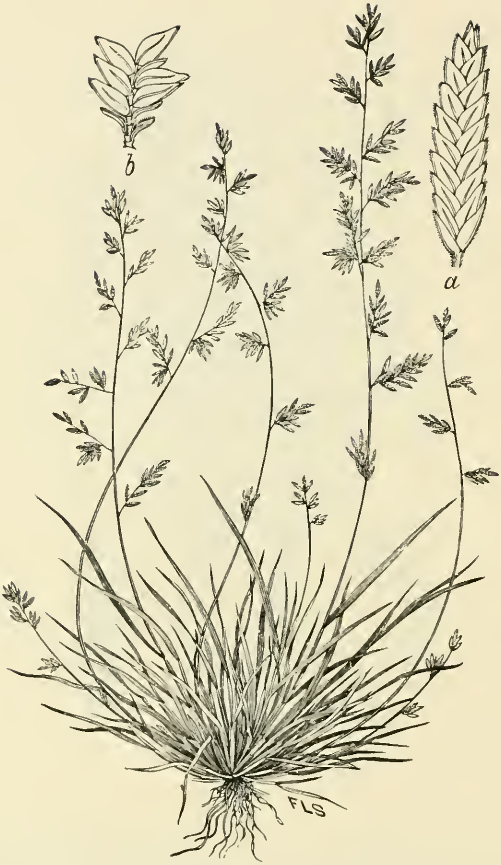


Fig. 244. **Eragrostis brownei** Nees (?).—A widely spreading, branching perennial, with somewhat wiry culms 2 to 5 dm. long, and narrow, simple, more or less interrupted panicles of nearly sessile, ten- to forty-flowered spikelets.—Dooryards and waste ground, Florida. [Widely distributed in tropical and subtropical regions.] July–October.

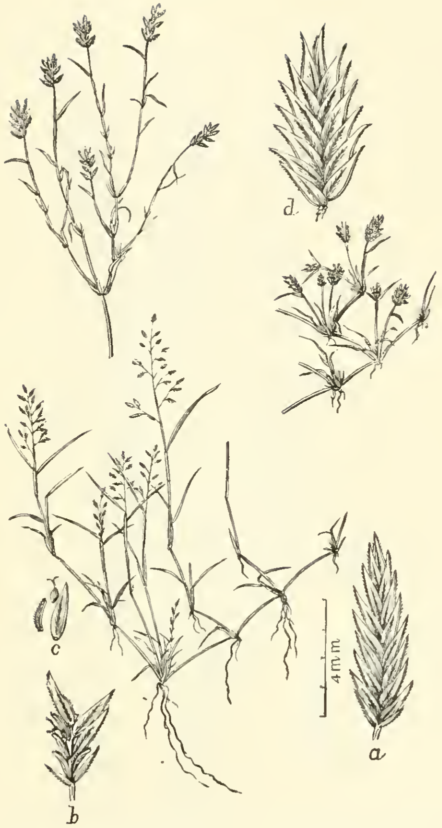


Fig. 245. **Eragrostis hypnoides** (Lam.) B. S. P. (*Poa hypnoides* Lam.; *E. reptans* Nees).—A prostrate, much-branched, and extensively creeping annual, with ascending, flowering branches 7.5 to 15 cm. high, spreading leaf blades, narrow and lax or very dense panicles and long, linear-lanceolate, strongly compressed spikelets.—In ditches and sandy banks of streams, Vermont and Ontario to Florida, Texas, California, and Washington. [Mexico, West Indies, and South America.] March–October.

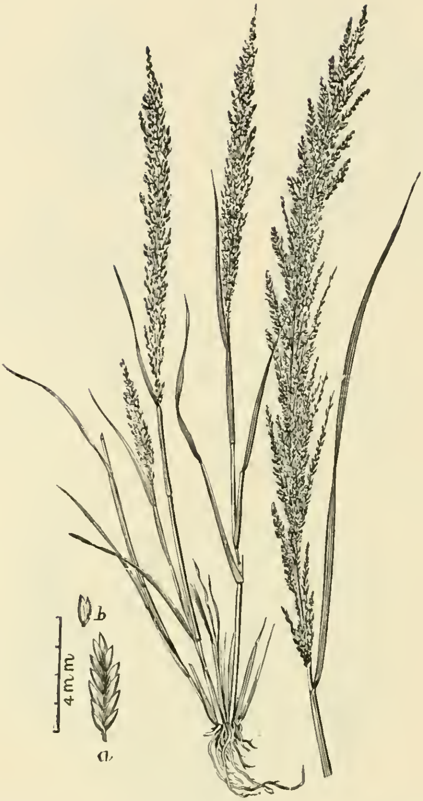


FIG. 246. **Eragrostis glomerata** (Walt.) L. H. Dewey (*Poa glomerata* Walt.; *P. conferta* Ell.; *Eragrostis conferta* Trin.).—An erect, rather stout, branching annual 6 to 9 dm. high, with smooth sheaths and leaves, and elongated, densely flowered, light-colored panicles 25 to 60 cm. long.—Low grounds, South Carolina to Florida and westward to Texas. [Cuba, Mexico, and South America.] August–November.

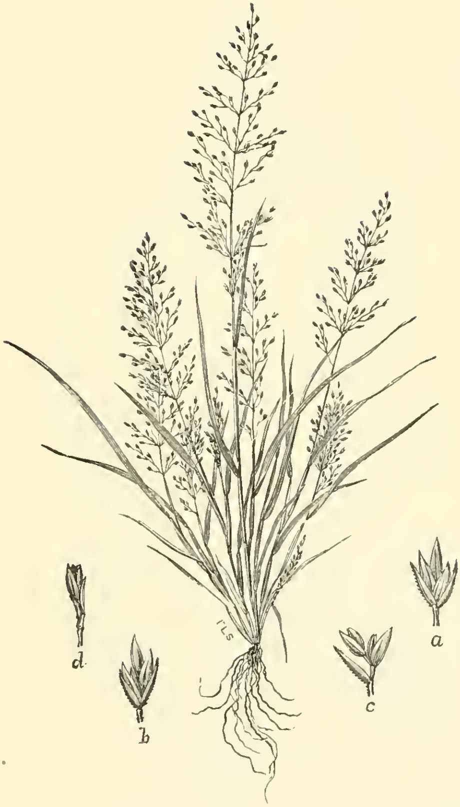


FIG. 247. **Eragrostis frankii** Steud. SHORT-STALKED MEADOW-GRASS.—A low, diffusely branched annual 0.8 to 1.5 dm. high, with open, many-flowered panicles 5 to 12 cm. long.—Low, sandy ground in the open, southern New York to Minnesota, south to Georgia, Louisiana, and Kansas. August–October.

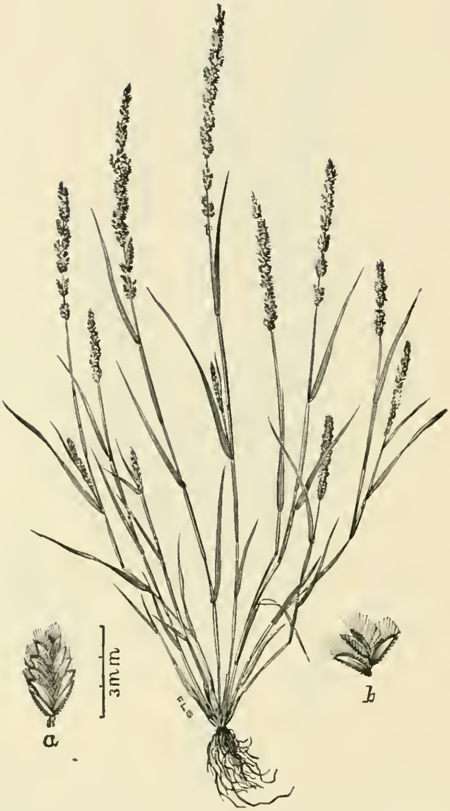


FIG. 248. **Eragrostis ciliaris** (L.) Link (*Poa ciliaris* L.).—A diffusely branching, slender annual 2 to 5 dm. high, with thin, narrow leaves and densely flowered, cylindrical, spike-like, more or less interrupted panicles 5 to 10 cm. long.—Cultivated and waste ground, Georgia and Florida to Mississippi. [Mexico, West Indies, and Asia.] July–October.

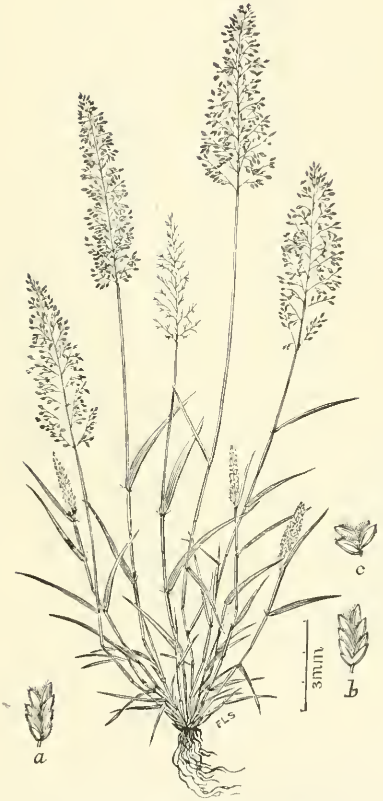


Fig. 249. **Eragrostis plumosa** Link. (*E. ciliaris patens* Chapm.).—A slender, diffusely branching annual 1 to 4 dm. high, with flat leaves and oblong, open panicles 5 to 15 cm. long.—Cultivated and waste ground, southern Georgia and Florida. [Widely distributed in tropical countries.] July–November.

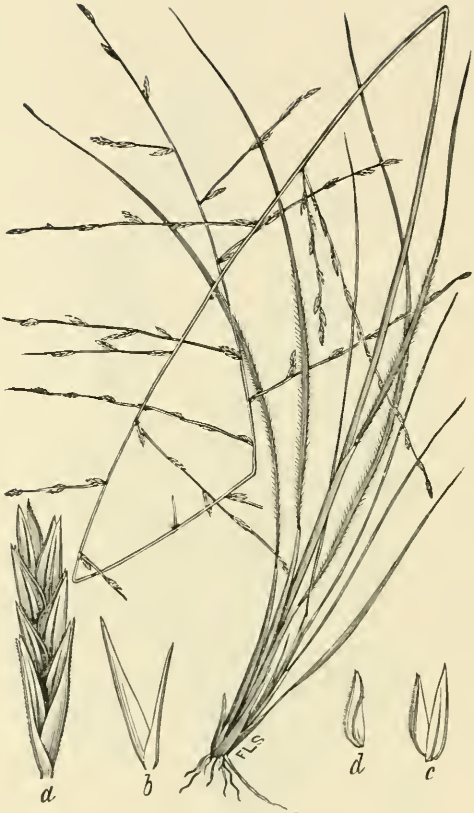


Fig. 250. **Eragrostis sessilispica** Buckl.; Britton and Brown, Ill. Fl., **1** : 190 (*Diplachne rigida* Vasey).—A smooth, wiry, cæspitose perennial 3 to 9 dm. high, with narrow, mostly involute leaves and pyramidal panicles, the five- to twelve-flowered, appressed spikelets sessile along the spreading branches.—Dry prairies, Kansas to Texas. June–October.

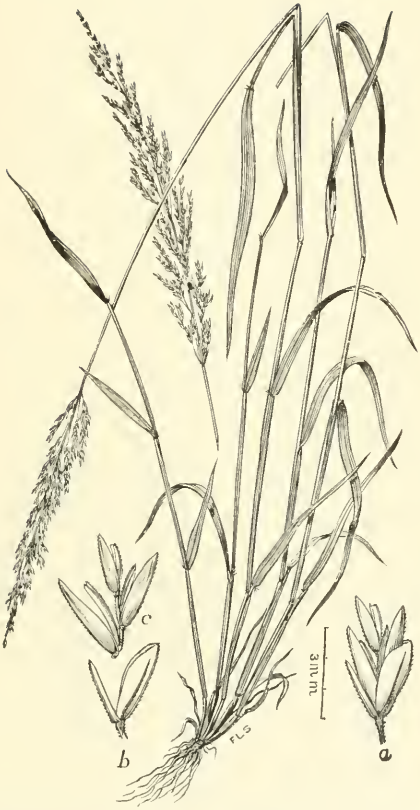


FIG. 251. **Eatonia pennsylvanica** (DC.) A. Gray. EATON'S-GRASS.—A slender, pale-green perennial, with flat leaf blades and narrow terminal panicles.—Wet meadows, low woods, and thickets, Newfoundland and Maine to British Columbia and Washington, south to Georgia, Mississippi, Texas, and Arizona. April-August.

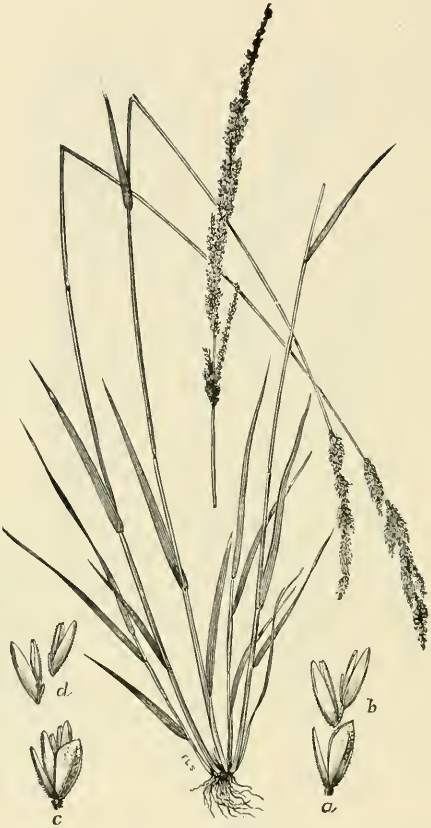


FIG. 252. **Eatonia obtusata** (Michx.) A. Gray. EARLY BUNCH-GRASS.—A tufted perennial 4.5 to 6 dm. high, with flat leaf blades and rather densely flowered, nodding panicles.—Low ground, chiefly along streams, usually in shade, Massachusetts and Ontario to Assiniboia and British Columbia, south to Florida, Texas, and southern California. March–August.

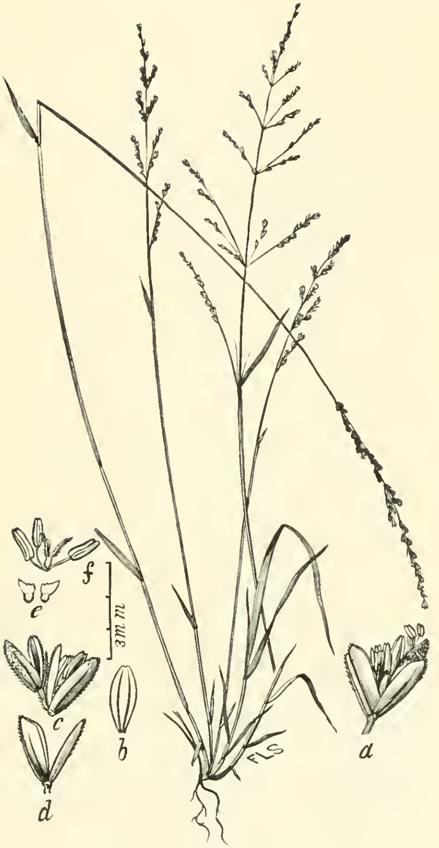


Fig. 253. **Eatonia nitida** (Sprengel) Nash (*Aira nitida* Spr.; *Eatonia dudleyi* Vasey).—A slender, erect, and cæspitose perennial 3 to 6 dm. high, with short, flat, spreading leaves and rather few-flowered, nodding panicles.—Dry, open woodlands, Rhode Island and New York westward to North Dakota, and southward to North Carolina, Mississippi and Texas. April–June.

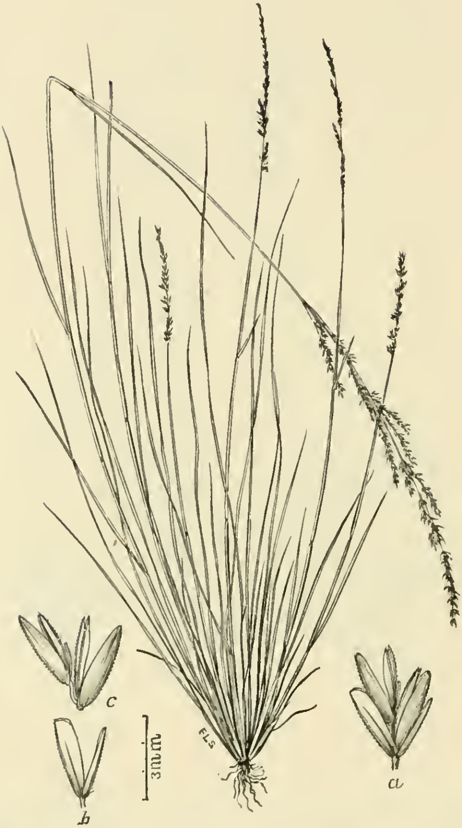


FIG. 251. **Eatonia filiformis** (Chapm.) Vasey; Beal, Grasses, N. Am., **2** : 491.—An erect, tufted perennial 3 to 6 dm. high, with very long upper internodes and long, involute, radical leaves.—Dry, sandy soil, South Carolina, Florida and Texas, north to western Tennessee. March, April.

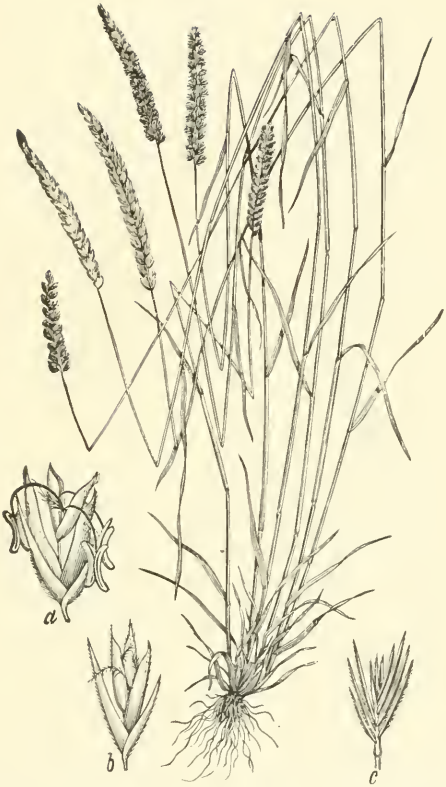


FIG. 255. **Cynosurus cristatus** L. DOG'S-TAIL-GRASS.—A slender, erect perennial 3 to 7½ dm. high, with narrow leaves and rather slender, erect, spike-like panicles.—Sparingly established in fields and waysides, Newfoundland to Ontario, south to New Jersey; Portland, Oregon. [Europe.] June-August.

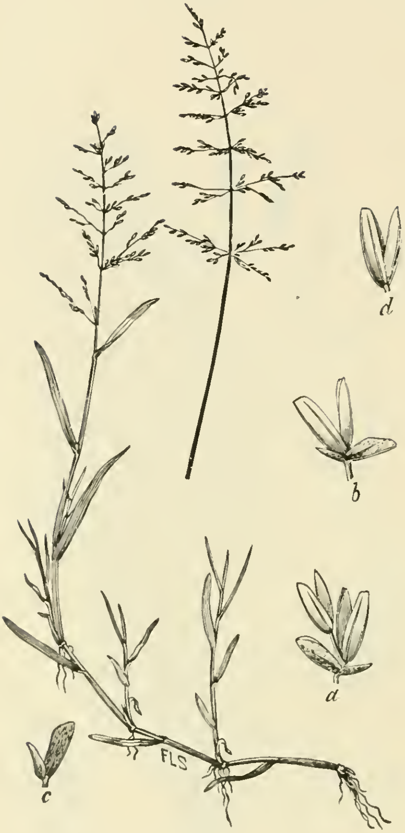


FIG. 256. **Catabrosa aquatica** (L.) Beauv.; Britton and Brown, Ill. Fl., **1**: 194. WATER WHORL-GRASS.—A smooth, soft perennial, with creeping or ascending culms 2 to 6 dm. long, flat leaves and open panicles 5 to 20 cm. long, the spreading branches in whorls.—In swales and along brooks, often in shallow water, Newfoundland and Labrador, to Quebec and Alaska, south to Nebraska, Colorado, and Utah. [Europe and Asia.] June–August.

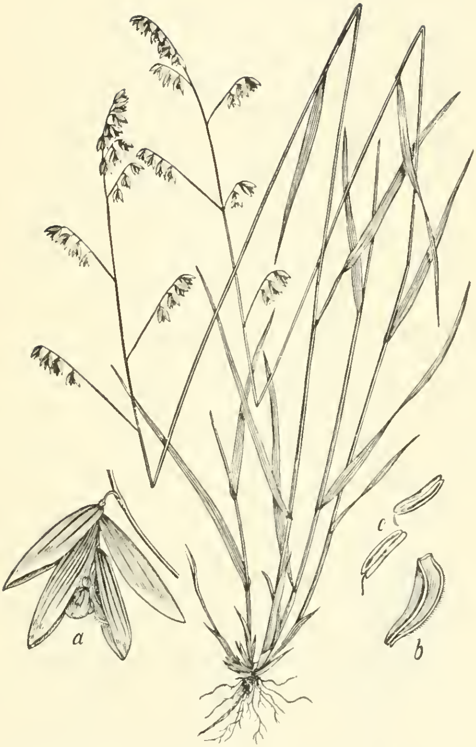


Fig. 257. **Melica mutica** Walt. (*M. glabra* Mx.).—A slender, loosely cæspitose, wiry grass 6 to 9 dm. high, with flat leaves and simple or racemose panicles of rather large, nodding, two- to three-flowered spikelets.—Dry, rocky, open woods and thickets, Pennsylvania to Florida and westward to Wisconsin and Texas. March-May.

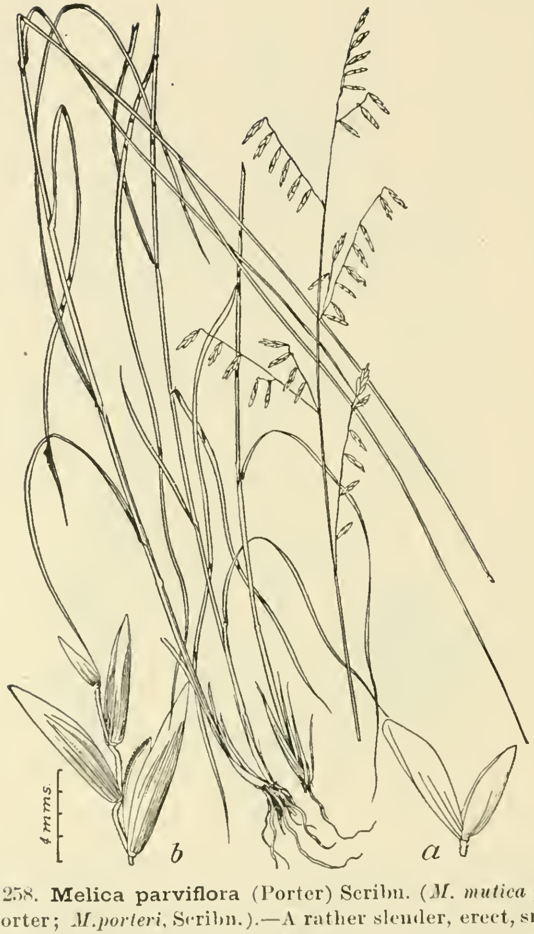


FIG. 258. **Melica parviflora** (Porter) Scribn. (*M. mutica parviflora* Porter; *M. porteri*, Scribn.).—A rather slender, erect, smooth perennial 4 to 7 dm. high, with flat leaves and narrow panicles 15 to 25 cm. long. Spikelets pendulous and racemose along the panicle branches.—Shaded canyons, mountains of Colorado, New Mexico, Arizona and prairies of Missouri, Kansas, and western Texas. [Northern Mexico.] July–September.

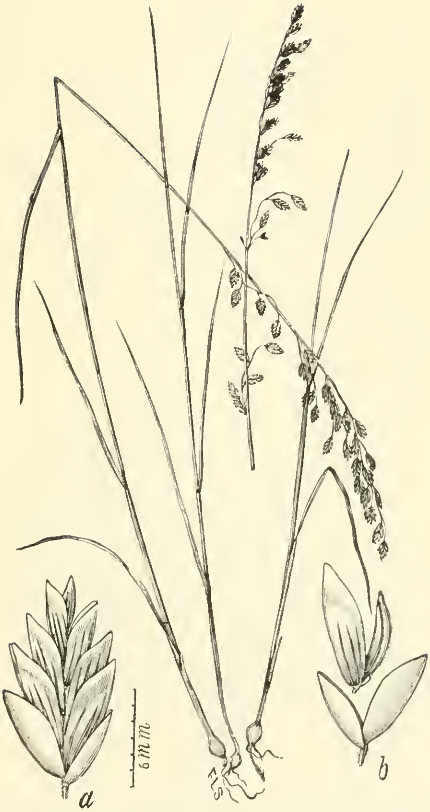


Fig. 259. **Melica spectabilis** Scribn.; Beal, Grasses N. Am., **2**: 506.—A cæspitose, stoloniferous species 3 to 6 dm. high, with scabrous, flat leaves, and loosely flowered, nodding, simple panicles 10 to 20 cm. long.—Damp grassy meadows, rich bottom lands, dry hillsides, etc. (alt. 950 to 2,400 m.), Montana to Washington and Oregon, south to Colorado, Wyoming, and Nevada. June–September.

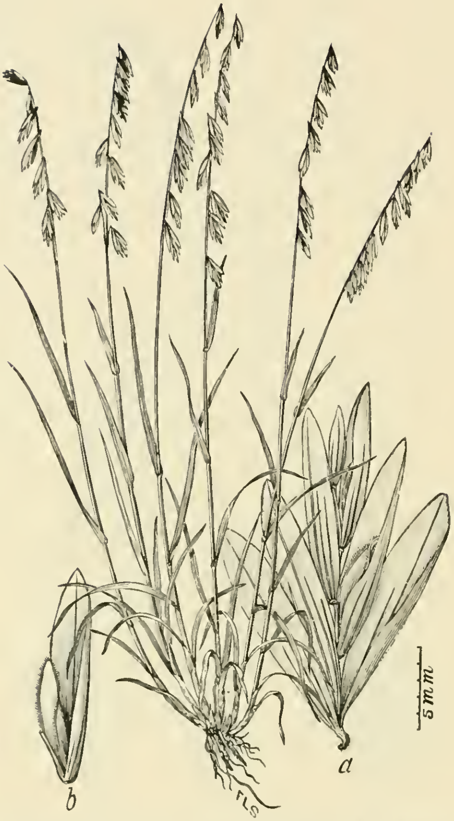


FIG. 260. **Melica stricta** Boland. Beal, Grasses N. Am., **2**: 503.
LARGE-FLOWERED MELICA.—A densely cæspitose perennial 2 to 5 dm. high from a bulbous base, with flat, more or less pubescent leaves, and simple, one-sided panicles 10 to 15 cm. long, bearing ten to twenty spikelets.—Dry ridges among rocks (alt. 1,850 to 2,700 m.), Nevada, California, and Oregon. June–August.

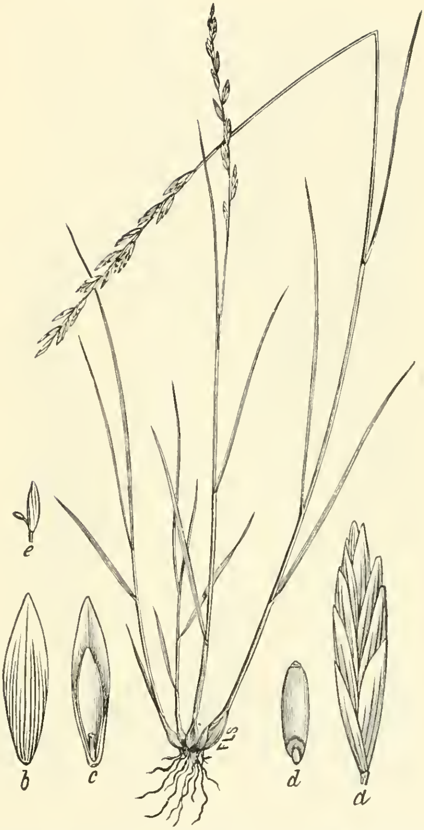


FIG. 261. **Melica bulbosa** Geyer; Beal, Grasses N. Am. **2** : 508. THICK-ROOTED BUNCH-GRASS.—A slender, erect perennial 3 to 6 or rarely 9 dm. high, bulbous at the base, with erect leaves and a narrow, somewhat spike-like panicle 10 to 15 cm. long.—Dry rocky slopes, moist shady mountain sides, etc. (alt. 900 to 2,700 m.), Montana and Wyoming to British Columbia, south to Utah, Nevada, and Oregon; western Texas. May–July.

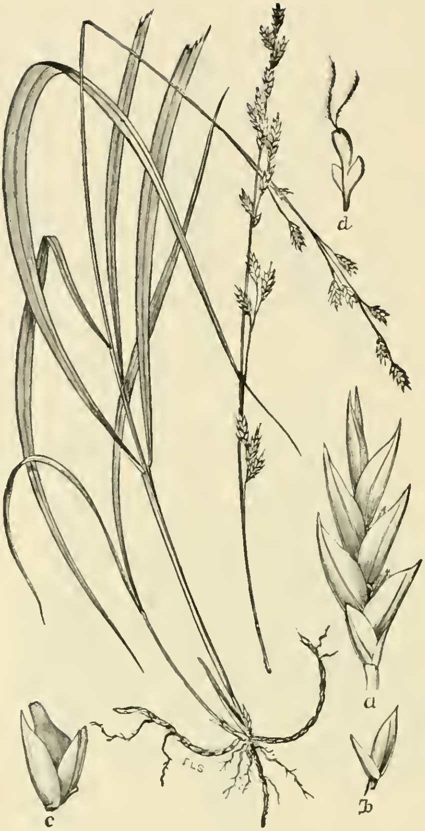


FIG. 262. **Korycarpus diandrus** (Michx.) Kuntze; Britton and Brown, Ill. Fl., **1**: 196; (*Diarrhena americana* Beauv.).—An erect perennial 6 to 9 dm. high, with long, narrow-lanceolate, nearly erect leaves and a few-flowered, simple panicle 10 to 25 cm. long.—Rich, rocky, wooded hillsides, Ohio to South Dakota, south to Georgia, Arkansas, and Indian Territory. August, September.

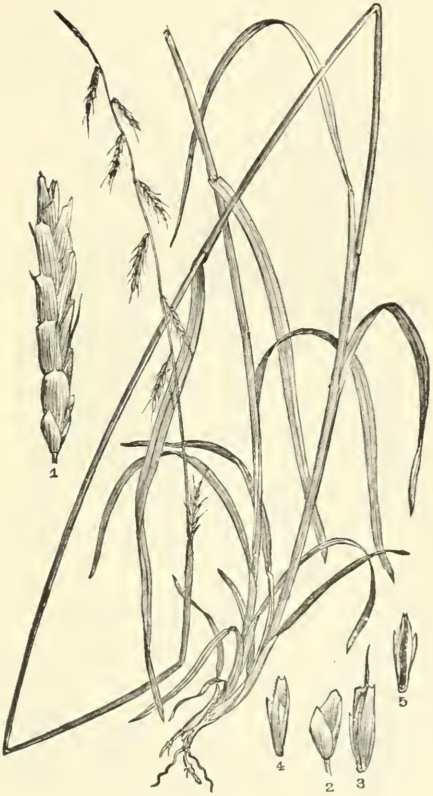


FIG. 263. **Pleuropogon refractum** (A. Gray) Benth. (*Lophochlæna refracta* A. Gray); Beal, Grasses N. Am., **2**: 514. NODDING PLEUROPOGON.—A slender perennial 6 to 12 dm. high from creeping rootstocks, with flat leaves and terminal racemes of six to ten drooping spikelets 2 to 3 cm. long.—In swamps and along mountain streams (alt. 1,200 to 3,850 m.), California to Washington. May–August.

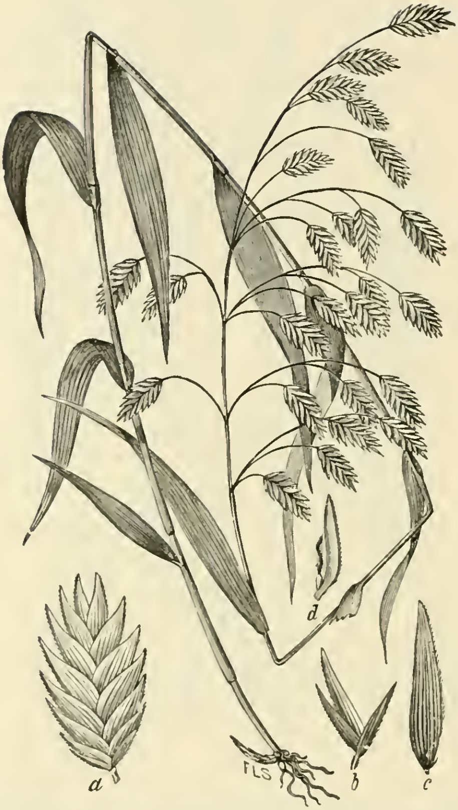


FIG. 264. **Uniola latifolia** Michx. BROAD-LEAFED SPIKE-GRASS.—An erect grass, with rather stout, simple culms 6 to 12 dm. high, broad, spreading leaf blades and a drooping panicle of large, flat spikelets 2 to 3 cm. long.—Low thickets and shaded banks of streams, Pennsylvania to Florida, west to Illinois, Kansas, and Texas. June-October.

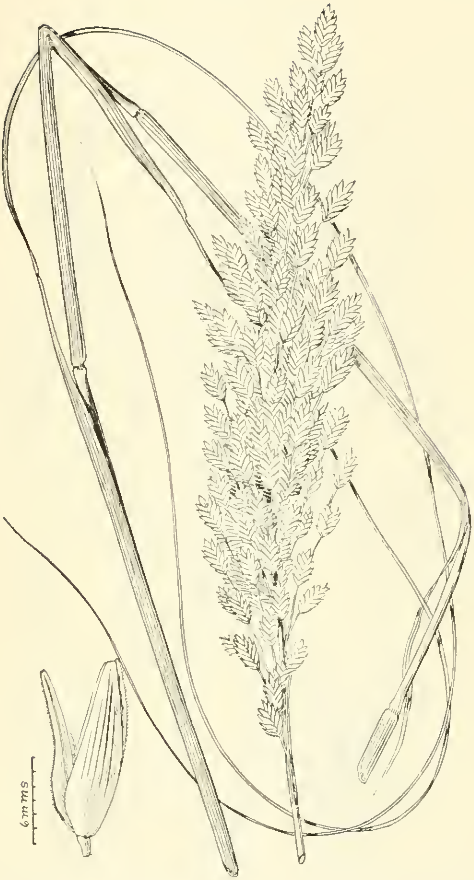


FIG. 265. **Uniola paniculata** L.; Beal, Grasses N. Am., **2**: 516. SEASIDE OATS.—A stout, native perennial 9 to 15 dm. high, with long, rigid leaves and showy, nodding panicles of many broad and pale straw-colored spikelets.—Drifting sand of sea beaches, Virginia to Texas. [West Indies and South America.] May–October.

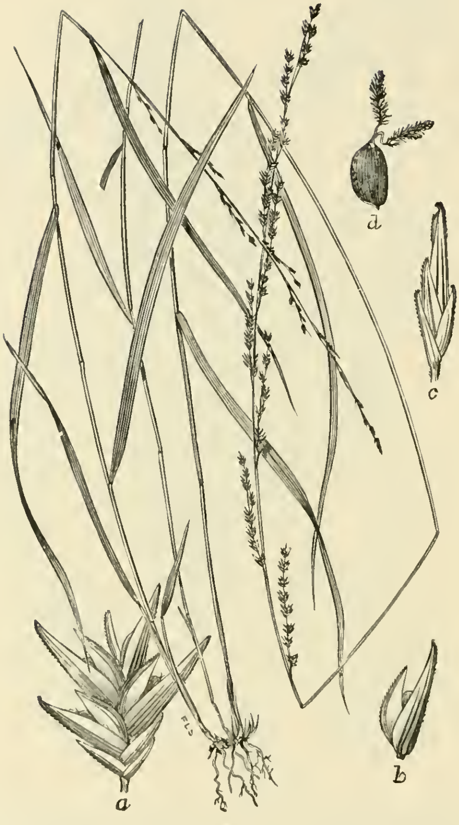


FIG. 266. **Uniola laxa** (L.) B. S. P.; Britton and Brown, Ill. Fl., 1: 197 (*U. gracilis* Michx.).—A slender grass 6 to 9 dm. high, with long, narrow leaf-blades, and a contracted, wand-like, nodding panicle 15 to 45 cm. long.—In dry soil, open woods, and banks, Long Island to Florida, west to Kentucky, Tennessee, and Texas. June-October.

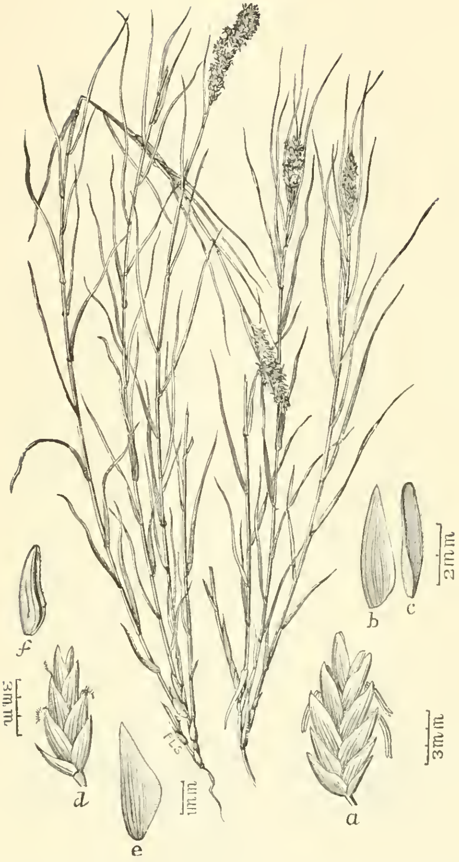


FIG. 267. **Distichlis spicata** (L.) Greene; Britton and Brown, Ill. Fl., **1**: 198 (*D. maritima* Raf.). ALKALI-GRASS.—An upright, wiry grass, 2.5 to 5 dm. high, with strong and widely creeping rootstocks, rather rigid leaves, and densely flowered panicles. The grass is diœcious.—Salt marshes along the coast, Maine to Texas and British Columbia to California; alkaline soil in the interior, Nebraska and Kansas to Montana, eastern Washington, California, and New Mexico. May-August.

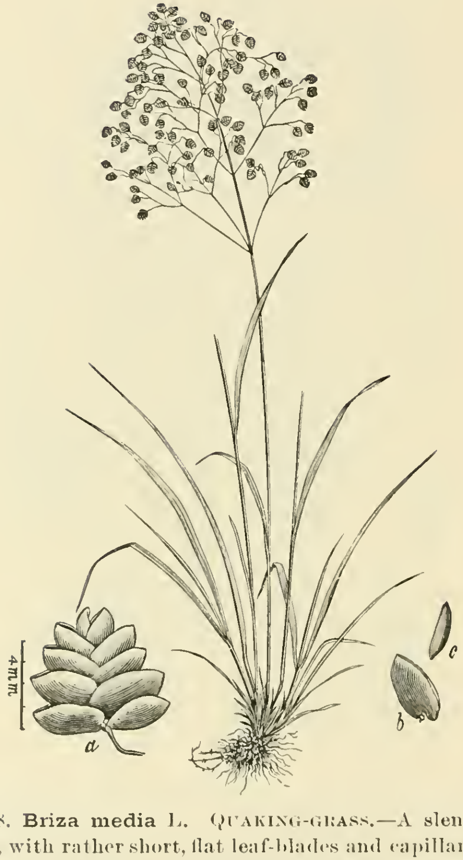


FIG. 268. **Briza media** L. QUAKING-GRASS.—A slender, erect perennial, with rather short, flat leaf-blades and capillary, spreading panicles.—Sparingly naturalized in fields and waste ground, in Ontario, New England, and California. [Europe and Asia.] May–July.

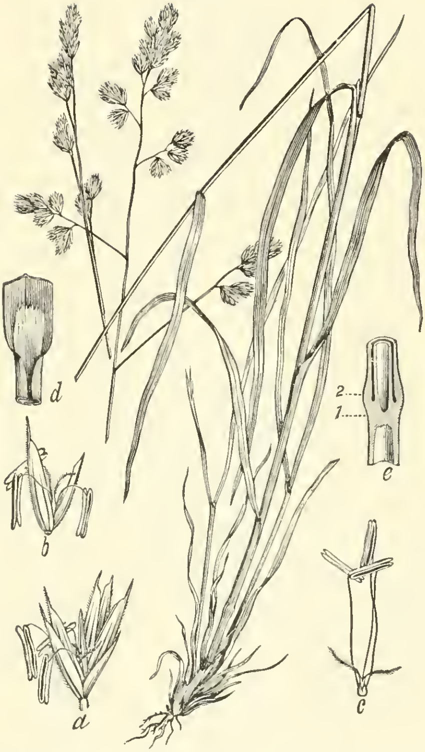


FIG. 269. **Dactylis glomerata** L. ORCHARD-GRASS.—A coarse, erect grass 9 to 12 dm. high, forming dense tufts, with long, flat leaf blades, and spikelets crowded in dense, one-sided clusters at the ends of the panicle branches.—Extensively naturalized in fields and waste ground, New Brunswick to South Carolina, west to Manitoba, Idaho, and Colorado. [Europe.] May-August.

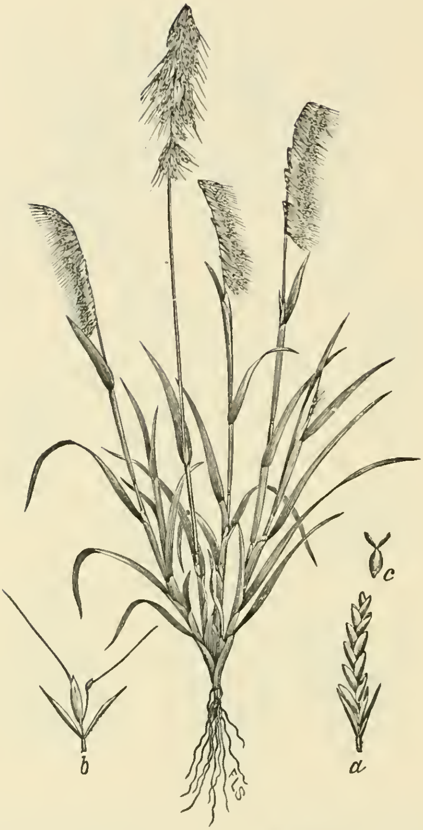


FIG. 270. **Lamarckia aurea** (L.) Moench. GOLDEN-TOP.—A caespitose, branching annual 1 to 3 dm. high, with elegant one-sided panicles 5 to 8 cm. long.—Introduced into southern and Lower California. [Southern Europe, northern Africa, and Australia.] March-May.

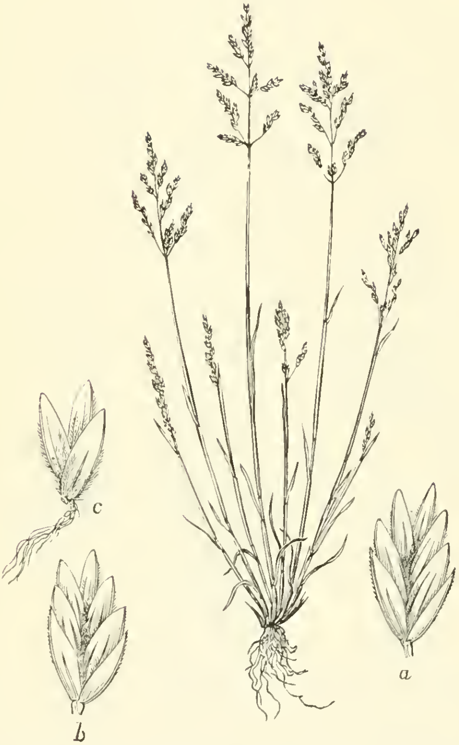


FIG. 271. **Poa chapmaniana** Scribn.—A low, cæspitose annual 1 to 2 dm. high, with ascending, flat leaves and usually narrow panicles 2 to 8 cm. long. Allied to *P. annua*, but more strict in habit of growth.—Dry sandy soil, southern Illinois to Mississippi and Georgia. April, May.

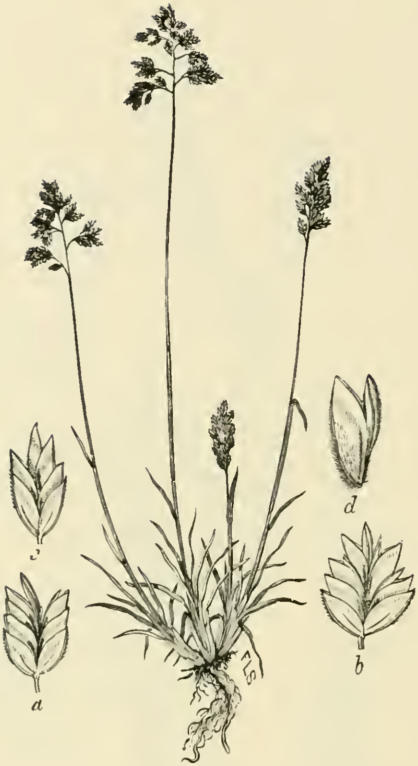


FIG. 272. **Poa alpina** L. MOUNTAIN SPEAR-GRASS.—A slender or stout, cæspitose, erect perennial 0.5 to 3 (usually 1.5) dm. high, with rather broad, flat leaves, and spreading pyramidal panicles of comparatively large spikelets.—Edges of brooks, open grassy mountain slopes, canyons, etc., Newfoundland and Quebec to Hudson Bay and Alaska, south in the mountains to Colorado (alt. 3,600 m.), Utah and California. [Widely distributed, arctic and subalpine.] June–August.

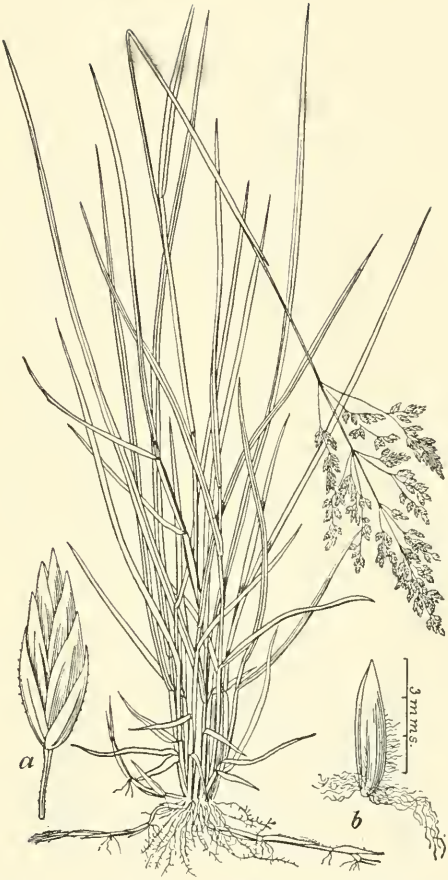


FIG. 273. **Poa pratensis L.** KENTUCKY BLUE-GRASS.—A slender, erect, stoloniferous perennial 3 to 9 dm. high, with narrow, flat leaves and more or less spreading, usually pyramidal panicles.—Fields and meadows throughout the United States and British America, abundantly naturalized in the East, indigenous in the North and West. [Europe and Asia.] Summer. A valuable pasture grass.

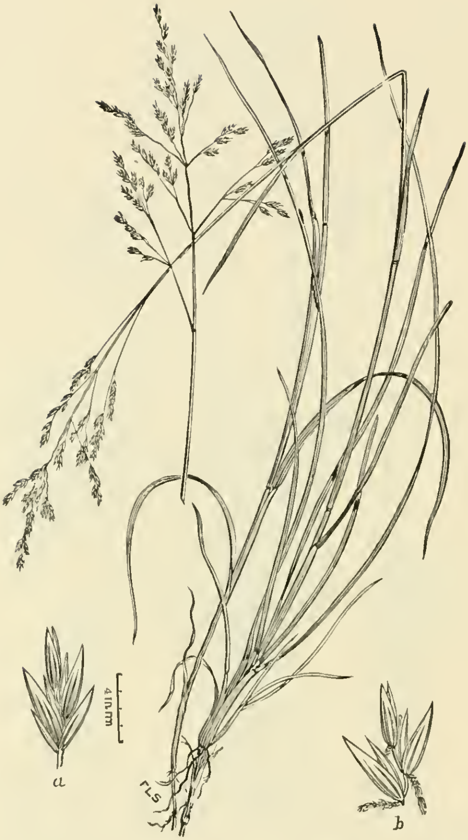


FIG. 274. **Poa kelloggii** Vasey; Ill. N. Am. Grasses, **2**: 79. KELLOGG'S SPEAR-GRASS.—A slender, erect or ascending perennial 4 to 6 dm. high, with rather long, flat leaves and open pyramidal panicles 7 to 10 cm. long. Spikelets two- to four-flowered.—California (4705 Bolander).

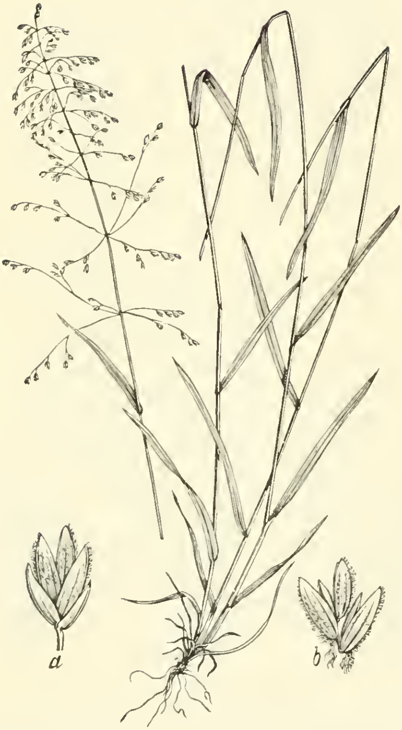


FIG. 275. **Poa sylvestris** A. Gray. WOODLAND SPEAR-GRASS.—A slender, tufted perennial 3 to 9 dm. high, with an open panicle 10 to 15 cm. long, the branches spreading or reflexed.—Rich woods and thickets, New York to Wisconsin and Nebraska, south to North Carolina, Louisiana and Texas. April-July.

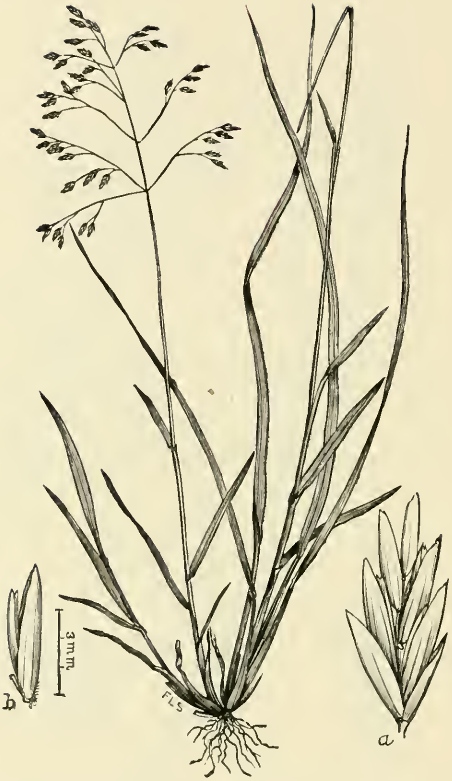


FIG. 276. **Poa brevifolia** Muhl. SOUTHERN SPEAR-GRASS.—An erect perennial 3 to 6 dm. high, with running rootstocks, short culm leaves, and a widely spreading, few-flowered panicle.—Wooded river bluffs and the grassy summits and wooded slopes of mountains, New Jersey to northern Ohio and Illinois, south to North Carolina and Tennessee. March–May.

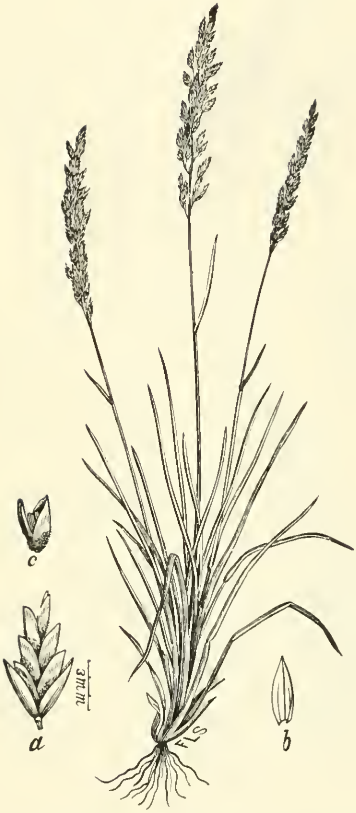


FIG. 277. **Poa arida** Vasey; Britton and Brown, Ill. Fl., **1**: 208. PRAIRIE SPEAR-GRASS.—An erect, often rather rigid, stoloniferous perennial 3 to 6 dm. high, with flat or folded, stiff leaves and narrow, rather densely flowered panicles 8 to 15 cm. long.—Meadows and low grounds, Northwest Territory to Kansas and Arizona. April-August.

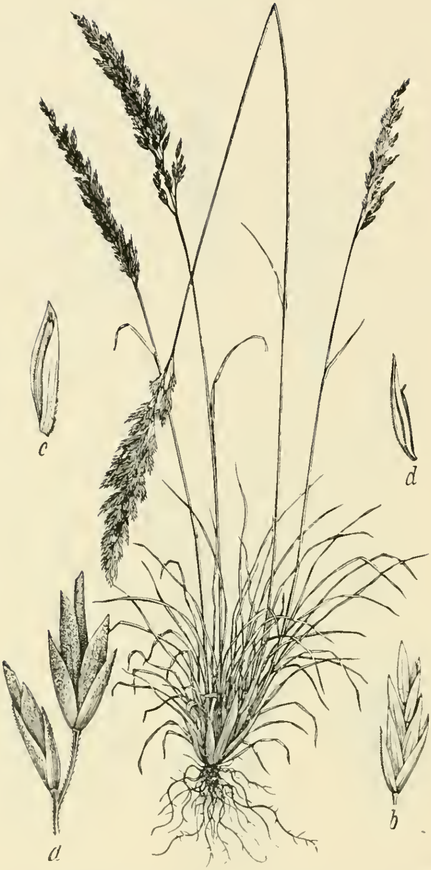


FIG. 278. **Poa buckleyana** Nash; Britton and Brown, Ill. Fl., 1 : 208 (*Poa tenuifolia* Buckley). BUNCH RED-TOP.—A rather slender, erect perennial "bunch grass" 3 to 6 dm. high, with numerous, soft radical leaves and a narrow panicle.—Usually in dry soil of "bench" lands, mountain slopes, elevated prairies, etc. (alt. 150 to 3,900 m.), South Dakota to British Columbia, Colorado, and California. May–September.

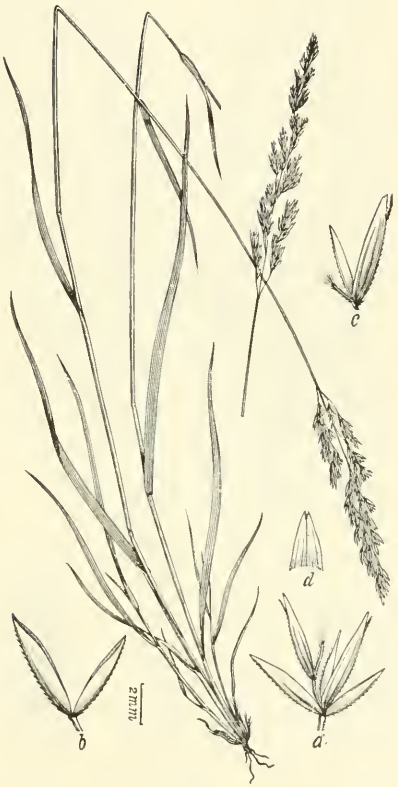


FIG. 279. **Graphephorum melicoideum** (Michx.) Beauv.—A rather slender, erect, pale-green, cæspitose perennial 3 to 6 dm. high, with flat leaves and loosely flowered, nodding panicles 7 to 14 cm. long.—Rocky or gravelly river shores, low woods (sometimes pine woods), etc., Anticosti Island to Vermont, Michigan, and Northwest Territory. August, September. (Allied to Trisetum.)

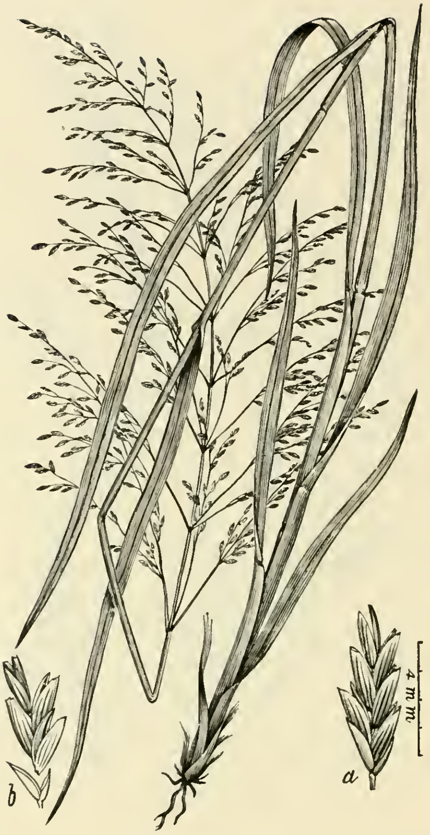


Fig. 280. **Panicularia aquatica** (Sm.) Kuntze (*Glyceria aquatica* J. E. Smith). Reed Meadow-grass.—A stout perennial 9 to 15 dm. high, with rather broad, flat leaf blades and an ample open panicle.—Shaded banks of streams, wet meadows, moist thickets, etc., New Brunswick to Alaska, south to Pennsylvania, Tennessee, Nebraska, New Mexico, and southern California. June-August.

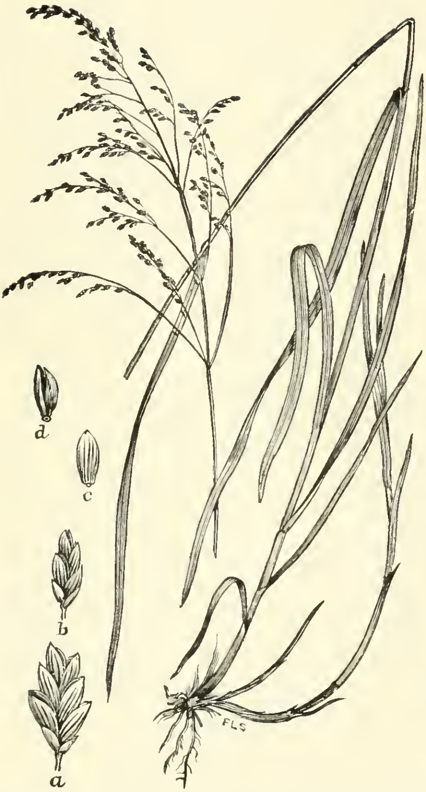


Fig. 281. **Panicularia nervata** (Willd.) Kuntze (*Glyceria nervata* Trin.). Fowl Meadow-grass.—A leafy perennial 3 to 9 dm. high, with an expanded, nodding panicle, and rather small spikelets.—Wet meadows, marshes, moist thickets, etc., Newfoundland to Florida, west to British Columbia, California, and Arizona. June–September.

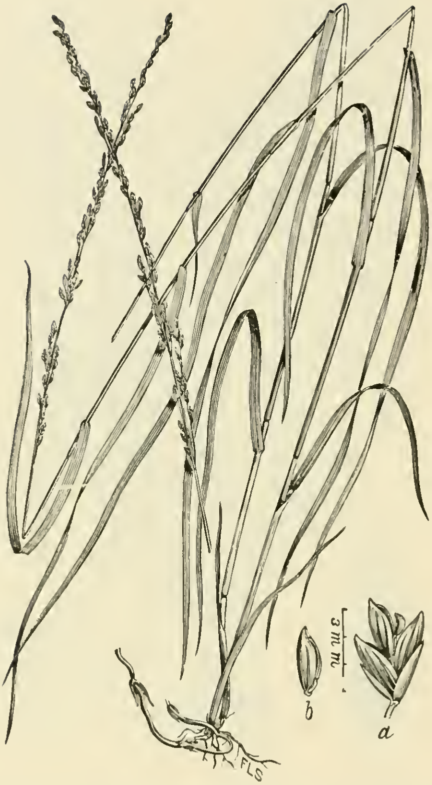


FIG. 282. **Panicularia elongata** (Torr.) Kuntze (*Glyceria elongata* Trin.) (*Poa elongata* Torr.).—An erect perennial 6 to 9 dm. high, with flat leaf blades and narrow, rather densely flowered panicles.—In rich, wet woods, Newfoundland and New Brunswick to North Carolina, west to Quebec, Minnesota, and Kentucky. July–September.

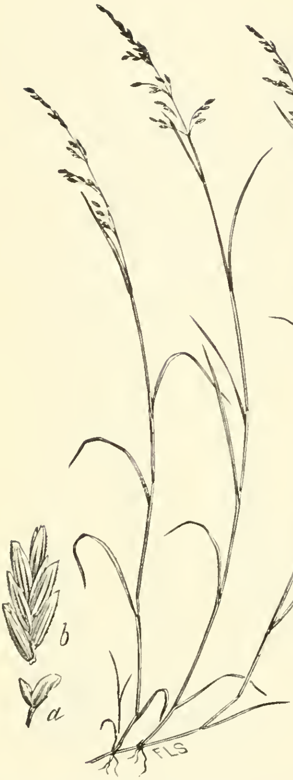


Fig. 283. **Panicularia pallida** (Torr.) Kuntze (*Glyceria pallida* Trin. *Windsoria pallida* Torr.). Pale Manna-grass.—A perennial, with slender stems 3 to 9 dm. long, ascending from a more or less decumbent base, and a lax, few-flowered panicle with ascending branches.—Bogs, banks of streams and ponds, Cape Breton to Ontario, south to Virginia, eastern Tennessee and Indiana. June–August.

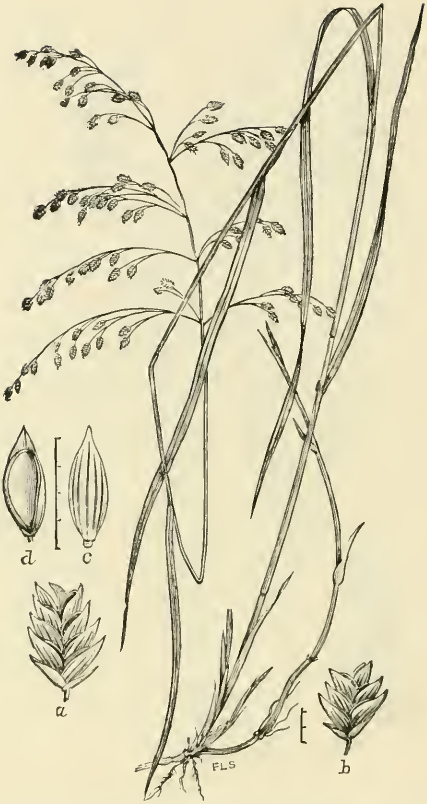


Fig. 284. **Panicularia canadensis** (Michx.) Kuntze; Britton and Brown, Ill. Fl., **1**: 211 (*Glyceria canadensis* Trin.). Rattlesnake-grass.—A stout, native perennial 6 to 9 dm. high, with flat leaves, and ample, nodding panicles of rather large spikelets.—Marshes and ditches. Newfoundland and Nova Scotia to Minnesota, south to New Jersey, Ohio, and Kansas. June–August.

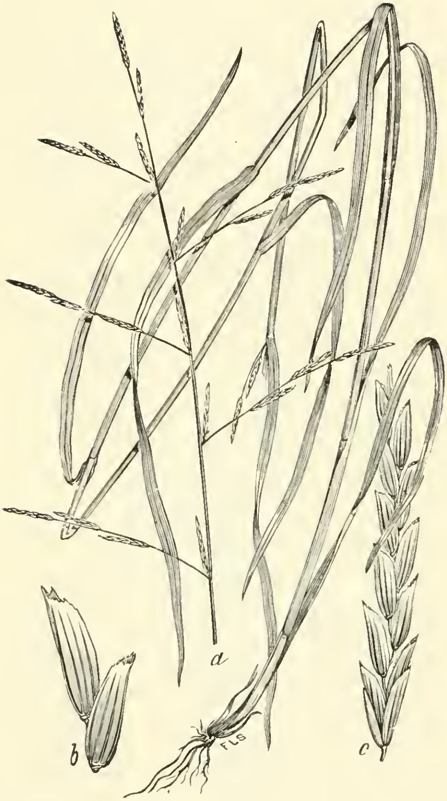


FIG. 285. **Panicularia fluitans** (L.) Kuntze (*Glyceria fluitans* R. Br.). FLOATING MANNA-GRASS.—An erect grass 9 to 15 dm. high with somewhat flattened culms, long leaves, and a narrow panicle about 3 dm. long.—Wet places, often in running water, Newfoundland to Alaska, south to North Carolina, Tennessee, Texas, and California. [Widely distributed in temperate regions.] May–September.

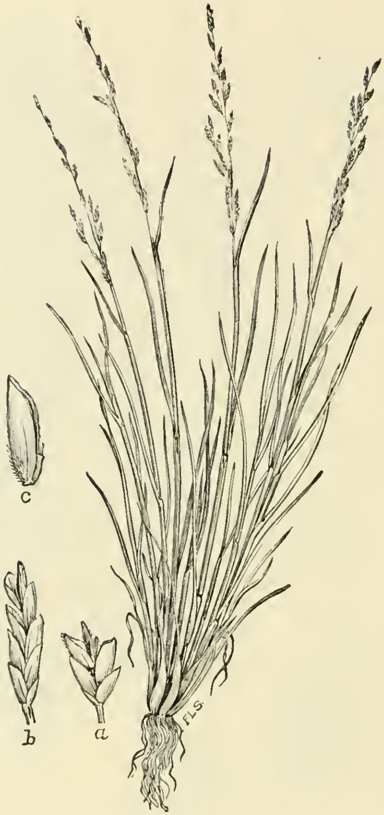


FIG. 286. **Puccinellia maritima** (Huds.) Parl. (*Poa maritima* Huds.; *Glyceria maritima* M. & K.). SEA SPEAR-GRASS.—A slender perennial 2 to 5 dm. high, from creeping rootstocks, with narrow, flat, or folded leaves, and more or less expanded panicles 8 to 12 cm. long.—Salt marshes and beaches along the coast, Labrador to southern New England, and Alaska to British Columbia; also on ballast and waste ground in sea ports farther south. [Europe and Asia.] July, August.

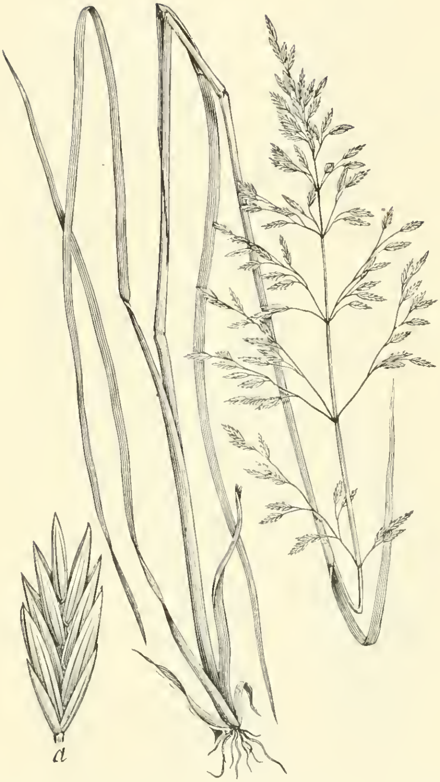


FIG. 287. **Festuca elatior arundinacea** (Schreb.) Hack. REED FESCUE.—A stout, leafy perennial 9 to 12 dm. high, with broad, flat leaves, and ample, elongated panicles often 3 dm. long.—Introduced here and there, District of Columbia, Michigan, Utah, Oregon, etc. [Europe.] August.

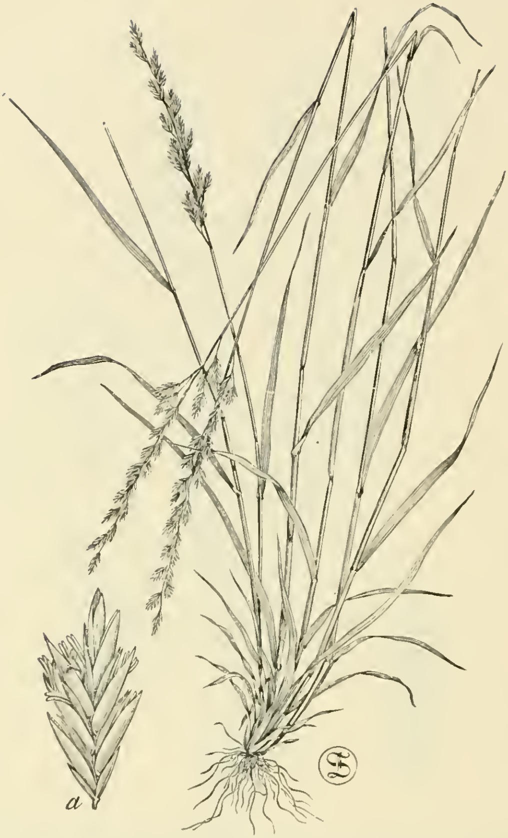


Fig. 288. **Festuca elatior pratensis** (Huds.) Hack. Meadow Fescue.—An upright perennial 6 to 9 dm. high, with numerous flat leaves and a rather narrow panicle 10 to 20 cm. long.—In fields and waysides, introduced, Nova Scotia to North Carolina, west to Washington, Oregon, and Kansas. June–August.

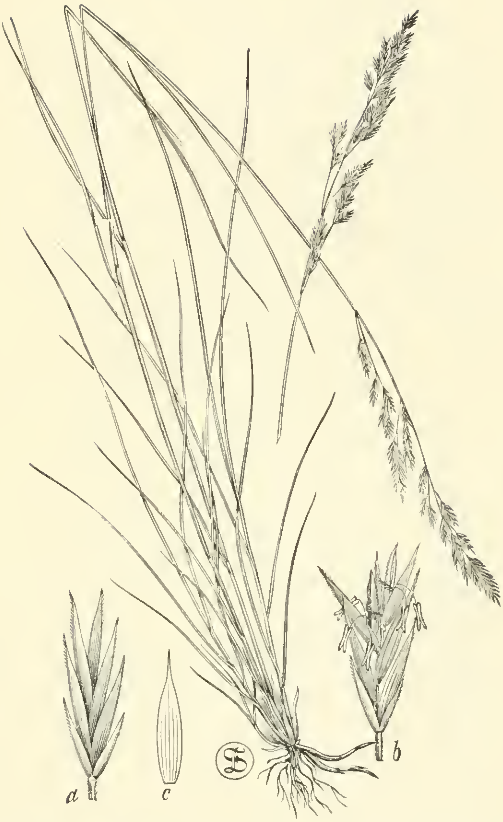


FIG. 289. **Festuca rubra glaucescens** Hack.; Beal, Grasses N. Am., **2** : 606. TENNESSEE FESCUE.—A slender perennial 3 to 6 dm. high, with creeping rootstocks, erect or ascending stems, very narrow, usually glaucous leaves, and lax, nodding panicles. Forms a dense turf.—Bluffs of Cumberland River, Nashville, Tenn. May.

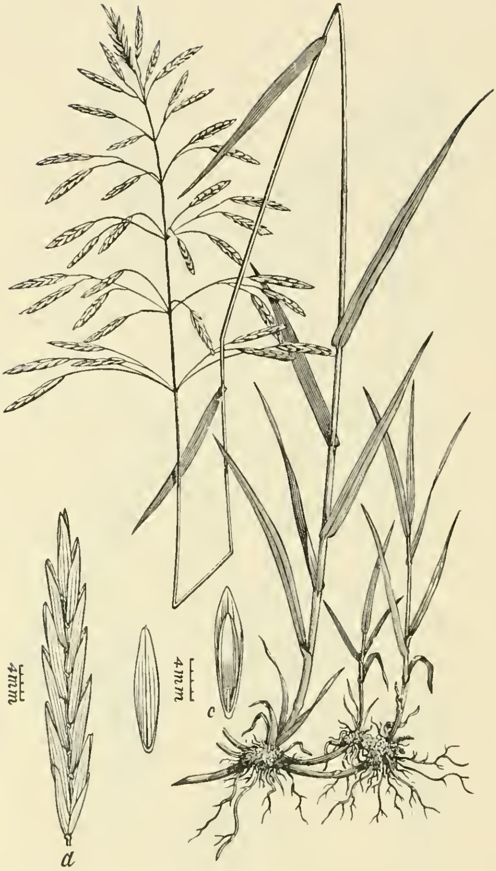


Fig. 290. **Bromus inermis** Leyss. Smooth Brome or Hungarian Brome-grass.—An erect perennial 6 to 15 dm. high, with creeping rootstocks, open panicles 12 to 18 cm. long, and five- to nine flowered, awnless spikelets 2 to 3 cm. long.—A native of Europe, introduced and cultivated in many parts of the United States for hay. June, July.

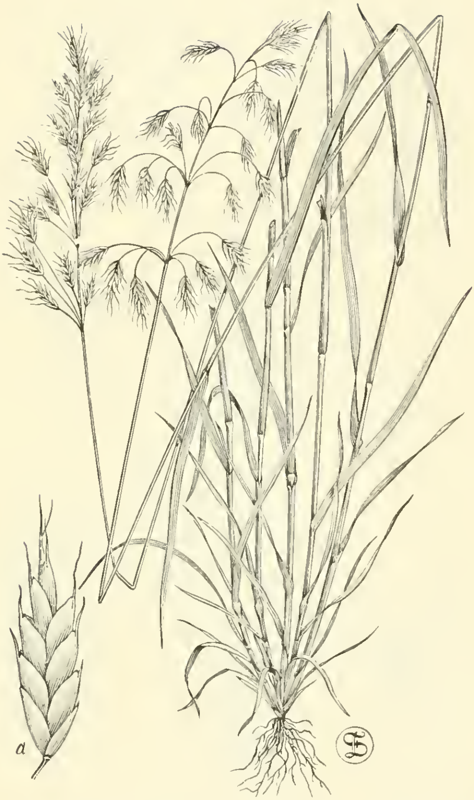


Fig. 291. **Bromus secalinus** L. Chess or Cheat.—An erect annual 6 to 9 dm. high, with flat leaves, more or less expanded panicles, and turgid, short-awned spikelets, which are pendulous in fruit.—Naturalized in cultivated and waste grounds, especially in grain fields. [Europe and Asia.] June-August.

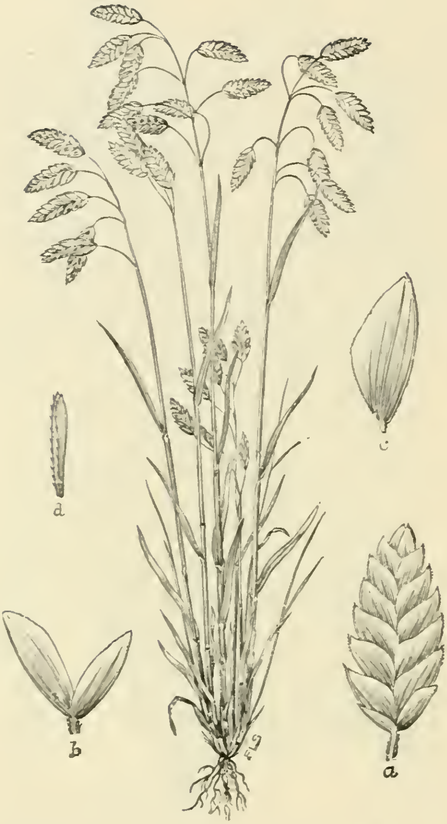


FIG. 292. **Bromus brizaeformis** Fisch. & Mey. BRIZA-LIKE BROME-GRASS.—A slender, erect, cæspitose annual 2 to 5 dm. high, with soft, flat leaves and nodding panicles of large ten- to fifteen-flowered spikelets 2 to 3 cm. long.—Meadows and cultivated fields, introduced, Montana to Washington, south to Utah, Nevada, and California: sparingly in Massachusetts, New York, and Pennsylvania. [Europe and Asia.] June–August.

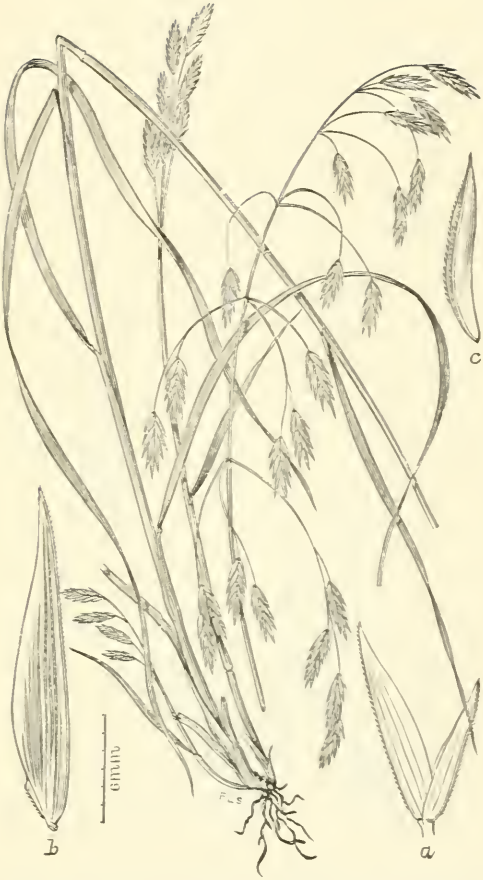


FIG. 293. **Bromus unioloides** (Willd.) HBK. RESCUE-GRASS.—An erect, usually annual grass, 3 to 9 dm. high, with more or less pubescent, flat leaf blades, and usually nodding, loose panicles of rather large, strongly flattened spikelets.—Prairies and dry, sandy fields. Indian Territory and Texas to Arizona; naturalized in Alabama. [Mexico and South America.] March–July.

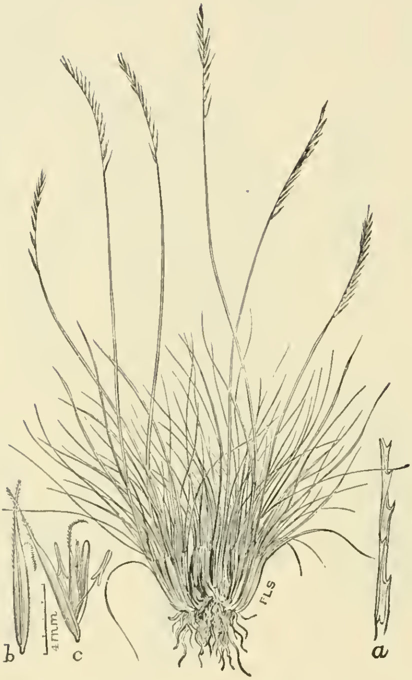


Fig. 294. **Nardus stricta** L.; Britton and Brown, Ill. Fl., **1**: 224. Wire Bent.—A glabrous, densely cæspitose perennial, with stout, creeping rootstocks, setaceous leaves, and erect, filiform, rigid culms, 10 to 20 cm. high.—Introduced at Amherst, Mass.; rocky river banks, Newfoundland. [Europe, Greenland and Azores.] August.

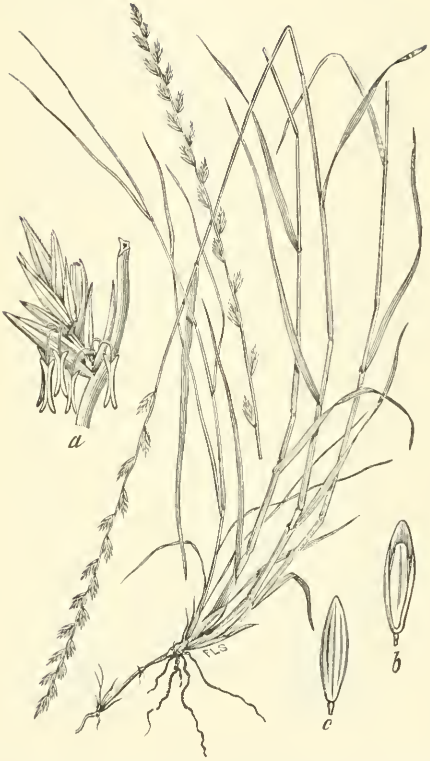


Fig. 295. **Lolium perenne L.** Rye-grass.—A smooth, leafy perennial 3 to 9 dm. high, with slender, terminal spikes 7.5 to 25 cm. long.—Lawns, fields, and waysides, naturalized, Canada to North Carolina, west to Ohio and Tennessee; California and Arizona. [Europe and Asia.] May–August.

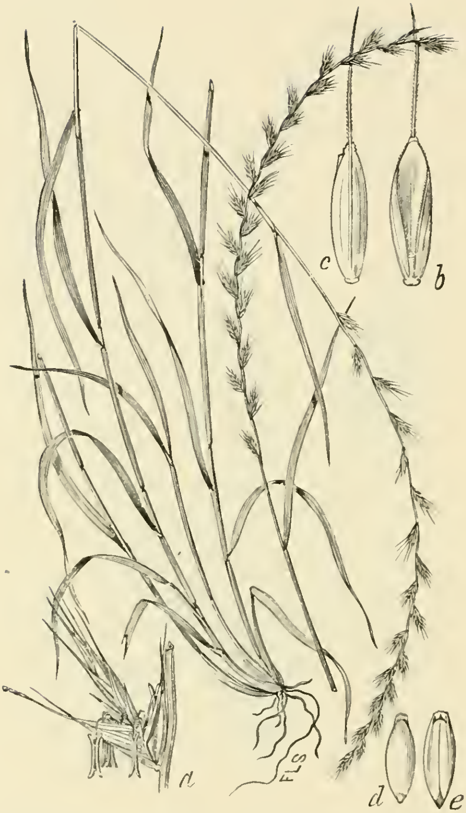


FIG. 296. **Lolium italicum** A. Br. ITALIAN RYE-GRASS.—A biennial or perennial grass 6 to 9 dm. high, with slender, usually somewhat nodding, terminal spikes, and short-awned spikelets. A valuable hay grass.—Introduced here and there through cultivation, especially on the Pacific Slope.

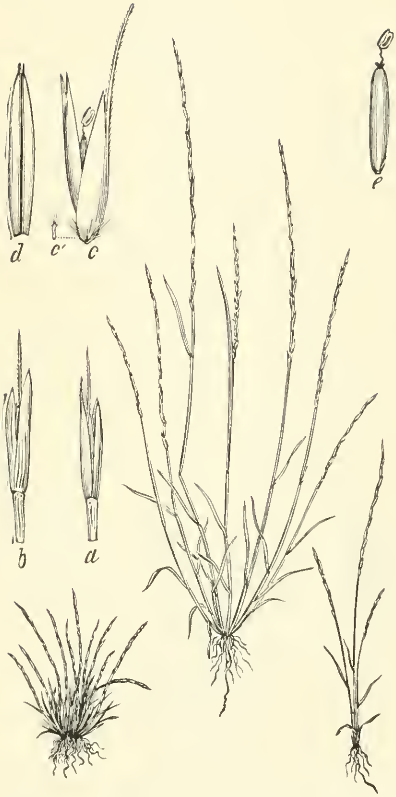


FIG. 297. **Scribneria bolanderi** (Thurb.) Hack. (*Lepturus bolanderi* Thurb.). Beal, Grasses N. Am., **2** : 634.—A slender, wiry, cæspitose annual 1 to 2 dm. high, with short, narrow leaves and terminal, slightly compressed spikes.—Sterile grounds, hillsides, and roadsides, Washington to California. May.

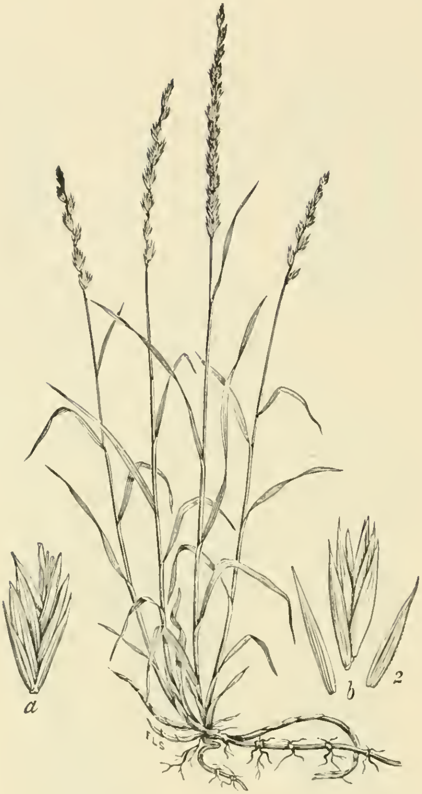


FIG. 298. **Agropyron repens** (L.) Beauv. (*Triticum repens* L.). COUCH-GRASS.—An erect, stoloniferous perennial 3 to 12 dm. high, with flat leaves, which are pilose along the nerves above, and terminal, densely flowered spikes.—Naturalized in lawns, waysides, and cultivated ground, Newfoundland and Cape Breton to Northwest Territory, south to District of Columbia, Ohio, and Iowa. [Europe and Asia.] June–September.

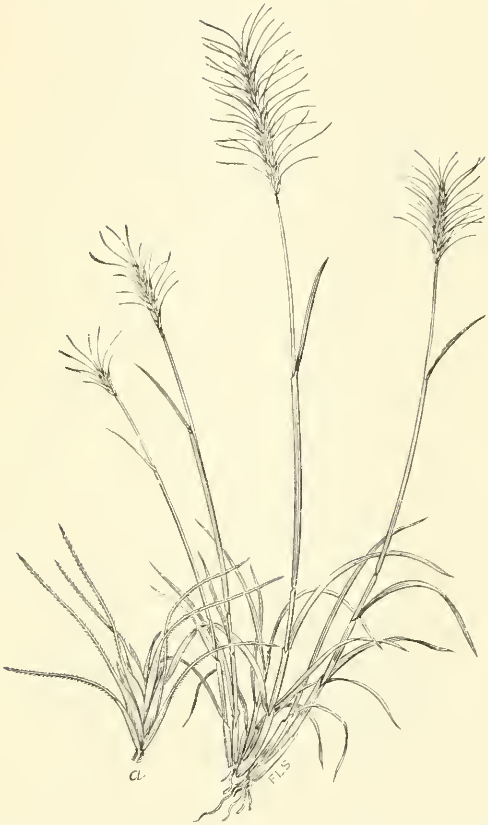


FIG. 299. **Agropyron scribneri** Vasey; Beal, Grasses N. Am., **2**: 638.—A densely cæspitose perennial 2 to 5 dm. high, with ascending culms, flat leaves, and bearded spikes 5 to 7 cm. long, which readily break up at maturity.—Summits of mountains (alt. 1,800 to 4,200 m.), Montana to Colorado and Arizona. August.

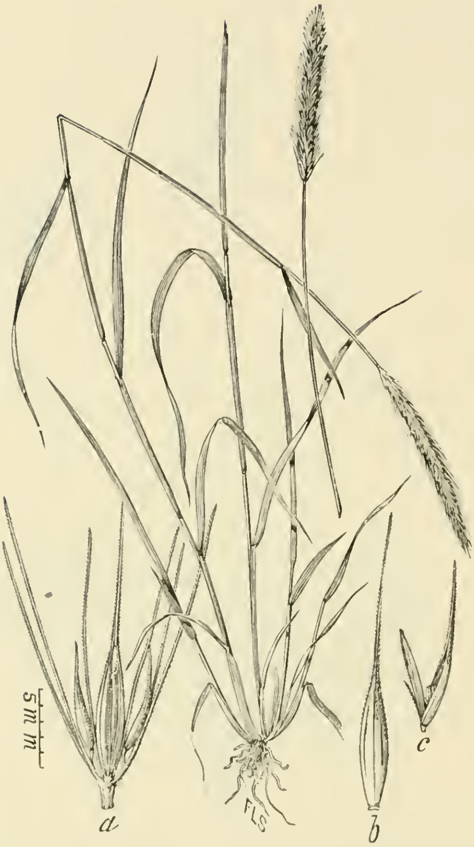


FIG. 300. **Hordeum boreale** Scribn. & Smith, Bull. 4, Div. Agrost., 28 (1897). NORTHERN WILD BARLEY.—A slender, erect and apparently perennial grass 3 to 6 dm. high, with rather broad, flat leaves, smooth culms and terminal spikes 7 to 10 cm. long.—Mountains of California to Alaska and Bering Sea islands. June, July.

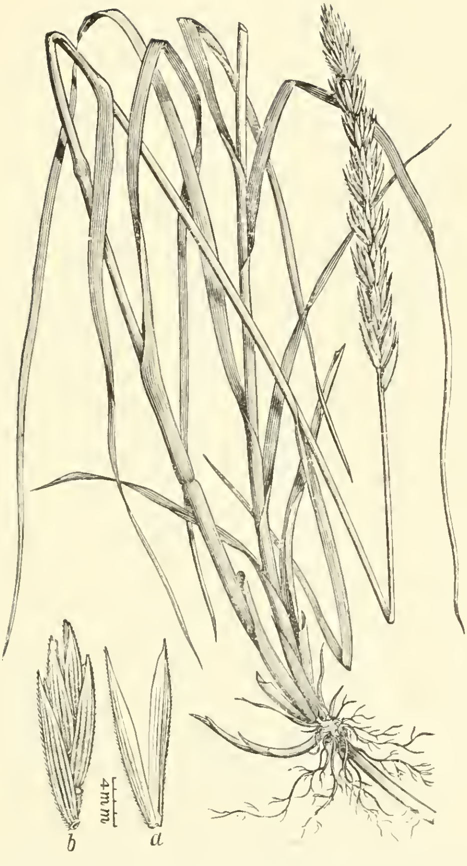


FIG. 301. **Elymus arenarius** L. SEA LYME-GRASS.—A stout, erect perennial 6 to 12 dm. high, with extensively creeping rootstocks, rather firm, flat, sharp-pointed leaves and terminal, usually densely flowered spikes 8 to 25 cm. long. Glumes usually villous.—In maritime sands, Greenland and Labrador to Maine; Alaska to California and on the shores of the Great Lakes. [Europe and Asia.] July, August.

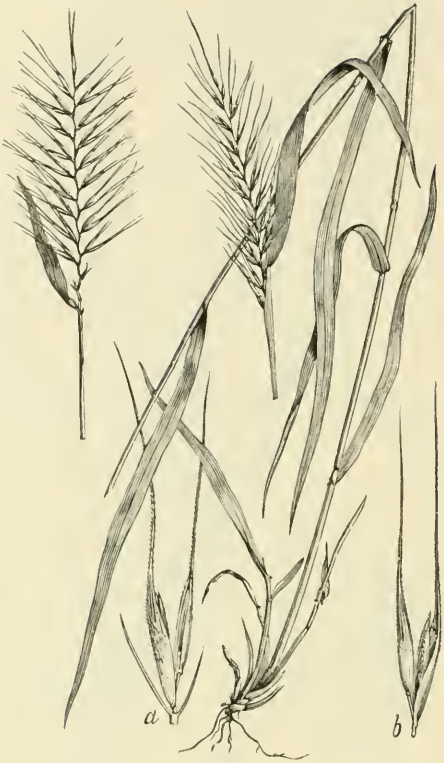


FIG. 302. **Asperella hystrix** (L.) Moench (*Asprella* W. not Schreb.; *Hystrix patula* Moench; *Gymnostichum hystrix* Schreb.). BOTTLE BRUSH.—A smooth, cæspitose perennial 6 to 12 dm. high, with rather broad, flat leaves and terminal spikes 6 to 12 cm. long. Spikelets widely spreading at maturity.—Fertile, rocky woods, New Brunswick and Ontario to Georgia, Alabama, Arkansas, and Minnesota. June–August.

INDEX TO THE COMMON NAMES.

Page.

- Alkali-grass 285
  - Saccatone 74
- American Oat 183
- Banner Sorghum 34
- Barley 14
- Barnyard-grass 82
- Beach-grass 167
- Bearded-joint 77
  - Short-husk 130
- Beard-grass 150
- Bermuda-grass 189
- Big Blue-stem 32
- Bitter Panic-grass 73
- Black Bunch-grass 38
  - Grama 37
  - Mountain Rice 110
- Blue Grama 222
- Bottle Brush 320
- Branching Foxtail 85
- Bristly Mesquite 223
- Briza-like Brome-grass 310
- Broad-leafed Spike-grass 282
- Brook-grass 27
- Broom Sedge 28
- Buffalo-grass 12, 238
- Bunch Redtop 296
- Burk's Grama 225
- California Hair-grass 172
- California Timothy 99
- Canary-grass 10
- Carpet-grass 42
- Catch-fly-grass 92
- Cheat 309
- Chess 309
- Clustered Salt-grass 230
- Common Reed 247
- Cotta-grass 241

Page.

- Cotton-grass 60
- Couch-grass 316
- Crab-grass 9, 258
- Creek Sedge 195
- Curly Mesquite 36
- Creeping Panic 70
  - Reimaria 40
- Crowfoot-grass 228
- Densely-flowered Bent 155
  - Plume-grass 21
- Dog's-tail-grass 273
- Downy Oat-grass 178
- Early Bunch-grass 270
  - Wild Oat-grass 171
- Eaton's-grass 269
- Elliott's Broom Sedge 30
  - Paspalum 41
- English Ray-grass 14
- Everlasting-grass 53
- False Buffalo-grass 245
- Feather-grass 237
- Few-flowered Sorghum 35
- Fine-top Salt-grass 145
- Flat-stemmed Panic 71
  - Sporobolus 143
- Floating Foxtail 133
  - Manna-grass 303
- Florida Amphicarpon 51
  - Paspalum 48
- Fowl Meadow-grass 299
- Fox-grass 192
- Freshwater Cord-grass 191
- Galleta 8, 39
- Gama-grass 19
- Gibbous Panic-grass 65
- Golden Top 288
- Goose-grass 227

Page.

- Green Foxtail, 83
- Hairy Grama, 220
- Havard's Grama, 216
- Herd's grass, 11
- Hungarian Brome-grass, 308
- Hungarian-grass, 86
- Indian Corn, 7
- Indian-grass, 33
  - Millet, 115
  - Reed, 152
- Italian Millet, 86
  - Ray-grass, 14
  - Rye-grass, 314
- Jamaica Crab-grass, 61
- Jungle Rice, 81
- Kellogg's Spear-grass, 292
- Kentucky Blue-grass, 13, 291
- Knot-grass, 43
- Large-flowered Melica, 278
- Large-leafed Vanilla-grass, 102
- Large Water-grass, 49
- Lemmon's Wool-grass, 54
- Little Blue-stem, 31
  - Crab-grass, 56
- Lizard-tail grass, 24
- Long awned Poverty-grass, 106
- Long-leafed Sporobolus, 139
- Long-spiked Bur-grass, 88
- Long-stalked Panic, 80
- Louisiana-grass, 42
- Maize, 7
- Many-flowered Trichloris, 208
- Many-spiked Chloris, 205
- Marram grass, 167
- Marshy Oat-grass, 177
- Mat-grass, 23
- Meadow Fescue, 306
  - Foxtail, 134
- Mexican Dropseed, 118
- Millet, 9
- Mission-grass, 90
- Morton's Oat-grass, 184
- Mountain Foxtail, 135
  - Hair-grass, 176
  - Spear-grass, 290
- Naked Beard-grass, 209

Page.

- Nealley's Leptochloa, 234
- Nimble Will, 117
- Nit-grass, 159
- Nodding Oat-grass, 182
  - Pleuropogon, 281
- Northern Panic-grass, 76
  - Wild Barley, 318
- Oat-like Hair-grass, 175
- Oats, 12
- One flowered Grama, 212
- Orchard-grass, 13, 287
- Pale Manna-grass, 301
- Phippsia, 136
- Porcupine-grass, 107
- Prairie-grass, 137
  - Spear-grass, 295
- Purple Canary-grass, 97
- Purple grass, 239
- Pursh's Amphicarpon, 50
- Quaking-grass, 286
- Rattlesnake-grass, 302
- Redfield's grass, 256
- Reed Fescue, 305
  - Meadow grass, 298
- Rescue-grass, 311
- Rice, 9
- Rice Cut-grass, 94
- Rocky Mountain Oat-grass, 179
- Rothrock's Grama, 221
- Rough Foxtail, 84
  - Leptochloa, 233
- Round-flowered Panic, 75
- Rush-like Spartina, 194
  - Timothy, 131
- Rye, 14
- Rye-grass, 313
- Salt Cedar, 244
  - Reed-grass, 190
- Sand Bur, 87
- Sea Lyme-grass, 319
- Sea Spear-grass, 304
- Seaside Finger-grass, 200
  - Oats, 283
- Seed Mesquite, 215
- Short-awned Grama, 219
  - Reed-grass, 161
- Short-haired Reed-grass, 168

Page.

- Short-leafed Beard-grass 210
- Short-stalked Eragrostis 260
  - Meadow-grass 265
- Side Oats 213
- Silky Oat-grass 188
- Silver Beard 29
  - Panic-grass 58
- Silvery Beard-grass 29
  - Hair-grass 170
  - Oat-grass 181
- Six-weeks Mesquite 214
- Slender Cut-grass 96
- Slender-flowered Dropseed 119
- Slender Hair-grass 174
  - Oat-grass 180
  - Panicum 57
  - Paspalum 44
- Slough grass 226
- Small-flowered Mountain Rice 114
- Small Grama 224
- Small-jointed Panic-grass 64
- Smooth Brome 308
  - Chloris 198
  - Crab-grass 55
  - Paspalum 45
- Smut-grass 144
- Soft Wool-grass 52
- Southern Canary-grass 98
  - Spear-grass 259, 294
  - Water-grass 59
- Spider Bent grass 158
- Sprouting Crab-grass 69
- Strong-scented Sporobolus 139
- Sugar Cane 7
- Swamp Poverty-grass 104
- Sweet Vernal-grass 10, 100
- Switch-grass 72
- Tall Grama 213

Page.

- Tall Oat-grass 185
- Tennessee Fescue 307
  - Oat-grass 187
- Texan Crab-grass 211
- Texas Blue-grass 13
  - Millet 62
- Thatch 195
- Thick-rooted Bunch-grass 279
- Thread-like Muhlenbergia 126
- Timothy 11, 132
- Toothache-grass 196
- Torrey's Silver Beard-grass 26
- Tufted Hair-grass 173
- Vanilla-grass 10, 101
- Velvet-grass 169
- Vine Mesquite-grass 63
- Viscid Leptochloa 231
- Warty Panic-grass 67
- Water Whorl-grass 274
- Western Cord-grass 193
- Wheat 14
- White-grass 95
- White Mountain Rice 111
- White Top 251
- Wild Millet 116
  - Mountain Rice 113
  - Oat-grass 186
  - Timothy 121
- Windmill-grass 203
- Wire Bent 312
- Wire-grass 103
- Wiry Grama 218
- Woodland Dropseed 120
  - Spear-grass 293
- Woolly-jointed Grama 217
  - Poverty-grass 105
- Wrinkly-flowered Paspalum 46
- Yard-grass 227

INDEX TO THE LATIN NAMES.

[Tribes in SMALL CAPITALS and synonyms in *italics*.]

Page.

- *Ægilops aromatica* 196
- Ægopogon 8
- Agropyron 14
  - repens 316
  - scribneri 317
- AGROSTIDEÆ 10, 12
- Agrostis 10, 11
  - *arachnoides* 158
  - *asper* 137
  - coarctata 154
  - *compressa* 143
  - densiflora 155
  - diegoënsis 157
  - elliottiana 158
  - *foliosa* 157
  - humilis 153
  - varians 153
- Aira 12
  - caryophyllea 170
  - *danthonioides* 175
  - *nitida* 271
  - præcox 171
  - subspicata 178
- Alopecurus 10, 11
  - geniculatus 133
  - occidentalis 135
  - pratensis 134
- Ammophila 11
  - arenaria 167
  - *arundinacea* 167
- Amphicarpon 9
  - floridanum 51
  - purshii 50
- Andropogon 7
  - argyræus 29
  - elliottii 30

Page.

- Andropogon *furcatus* 32
  - glomeratus 27
  - *macrourus* 27
  - nutans 33
  - pauciflorus 35
  - *polydactylon* 205
  - provincialis 7, 32
  - saccharoides 26
  - scoparius 31
  - *secundus* 34
  - *torreyanus* 26
  - unilateralis 34
  - virginicus 7, 28
- ANDROPOGONEÆ 7
- Anthænantia 9
- Anthoxanthum 10
  - odoratum 100
- Apera 11
- Arctagrostis 11
- Aristida 11
  - gossypina 105
  - *lanata* 105
  - palustris 104
  - stricta 103
  - tuberculosa 106
- Arrhenatherum 12
  - elatius 185
- Arundinaria 15
- Arundo 13
  - *brevipilis* 168
  - *phragmites* 247
  - *vulgaris* 247
- Asperella 14
  - hystrix 320
- *Asprella hystrix* 320
- Avena 12

Page.

- Avena americana 183
  - *elatior* 185
  - *hookeri* 183
  - mortoniana 184
  - sativa 12
  - *spicata* 186
- AVENEÆ 11, 12
- BAMBUSEÆ 14
- Beckmannia 12
  - erucæformis 226
- Blepharidachne 13
- Bouteloua 12
  - aristidoides 214
  - breviseta 219
  - burkii 225
  - curtipendula 213
  - eriopoda 217
  - havardi 216
  - hirsuta 223
  - oligostachya 222
  - *racemosa* 213
  - ramosa 218
  - rothrockii 221
  - texana 215
  - trifida 224
  - uniflora 212
  - vestita 220
- Brachyelytrum 11
  - *aristatum* 130
  - erectum 130
- Briza 13
  - media 286
- Bromus 13
  - brizæformis 310
  - inermis 308
  - secalinus 309
  - *spicatus* 229
  - unioloides 311
- *Buchloë* 12
  - *dactyloides* 238
- Bulbilis 12
  - dactyloides 238
- Calamagrostis aleutica 163
  - bolanderi 165
  - breviseta 161
  - crassiglumis 160

Page.

- Calamagrostis deschampsioides 162
  - howellii 166
  - *pickeringii* 161
  - tweedyi 164
- Calamovilfa 11
  - brevipilis 168
- Campulosus 12
  - aromaticus 196
  - chapadensis 197
- Capriola 12
  - dactylon 189
- Catabrosa 13
  - aquatica 274
- Cathestecum 13
  - *erectum* 242
  - prostratum 242
- Cenchrus 9
  - *granularis* 24
  - myosuroides 88
  - tribuloides 87
- Chætochloa 9, 86
  - composita 85
  - corrugata 84
  - glauca 83
  - viridis 83
- CHLORIDEÆ 12
- Chloris 12
  - *alba* 204
  - cucullata 202
  - *dubia* 235
  - elegans 204
  - floridana 199, 201
  - glauca 198
  - neglecta 199, 201
  - petræa 200
  - polydactylon 205
  - *swartziana* 200, 201
  - texensis 206
  - verticillata 203
- Cinna 10, 11
  - arundinacea 152
  - *macroura* 148
- Coleanthus 6, 11
- Colpodium 13
- *Corynephorus* 12
- Cottea 13

Page.

- Cottea pappophoroides 241
- *Crypsis schœnoides* 131
- *Ctenium* 12
  - *americanum* 196
  - *chapadense* 197
- *Cynodon* 12
  - *dactylon* 189
- Cynosurus 13
  - *ægyptius* 228
  - cristatus 273
- Dactylis 13
  - glomerata 13, 286
  - *maritima* 195
  - *patens* 192
- Dactyloctenium 12
  - *ægyptiacum* 228
  - ægyptium 228
- Danthonia 12
  - compressa 187
  - sericea 188
  - spicata 186
- Deschampsia 12
  - atropurpurea 176
  - calycina 175
  - elongata 174
  - flexuosa 173
  - holciformis 172
- *Diarrhena* 13
  - *americana* 280
- *Digitaria serotina* 56
- *Diplachne dubia* 235
  - *imbricata* 232
  - *reverchoni* 229
  - *rigida* 268
  - *spicata* 229
  - *viscida* 231
- Dissanthelium 13
  - californicum 257
- Distichlis 13
  - *maritima* 285
  - spicata 285
- Dupontia 13
- Eatonia 13
  - *dudleyi* 271
  - filiformis 272
  - nitida 271

Page.

- Eatonia obtusata 270
  - pennsylvanica 269
- Eleusine 6, 12
  - indica 227
- Elionurus 7
  - barbiculmis 25
- Elymus 14
  - arenarius 319
- Epicampes 11
  - ligulata 149
  - rigens 148
- Eragrostis 13
  - abyssinica 258
  - brownii 262
  - ciliaris 266
  - *conferta* 264
  - curtipedicellata 260
  - frankii 265
  - glomerata 264
  - hypnoides 263
  - neo-mexicana 258
  - pectinacea 260, 261
  - plumosa 267
  - purshii 259
  - *reptans* 263
  - sessilispica 268
- *Eremochloë* 13
- Erianthus 7
  - compactus 21
  - strictus 22
- Eriochloa 9
  - lemmoni 54
  - mollis 52
  - punctata 53
- Eriocoma cuspidata 115
- Euchlæna 7
- *Eustachys floridana* 201
  - *glauca* 198
- Festuca 13
  - elatior arundinacea 305
  - elatior pratensis 306
  - rubra glaucescens 307
- FESTUCEÆ 11, 13
- Gastridium 11
  - *australe* 159
  - lendigerum 159

Page.

- *Glyceria* 13
  - *aquatica* 298
  - *canadensis* 302
  - *elongata* 300
  - *fluitans* 303
  - *maritima* 304
  - *nervata* 299
  - *pallida* 301
- Gramineæ 5
- Graphephorum 13
  - *flexuosum* 256
  - melicoideum 297
- *Greenia arkansana* 151
- Gymnopogon 12
  - ambiguus 209
  - brevifolius 210
  - *racemosus* 209
- *Gymnostichum hystrix* 320
- Gynerium 13
- Hackelochloa 7
  - granularis 24
- Heleochloa 11
  - schœnoides 131
- *Hemarthria fasciculata* 23
- *Hierochloë* 10
  - *borealis* 101
  - *macrophylla* 102
- Hilaria 8
  - cenchroides 36
  - jamesii 38
  - mutica 37
  - rigida 39
- Holcus 10, 12
  - lanatus 169
- Homalocenchrus 9
  - hexandrus 93
  - lenticularis 92
  - monandrus 96
  - oryzoides 94
  - virginicus 95
- HORDEÆ 14
- Hordeum 14
  - boreale 318
- Hydrochloa 9
- *Hystrix patula* 320
- Imperata 7

Page.

- Imperata *brevifolia* 20
  - *caudata* 20
  - hookeri 20
- *Ischæmum secundatum* 90
- Kœleria 13
- Korycarpus 13
  - diandrus 280
- Lagurus 11
- Lamarckia 13
  - aurea 288
- *Leersia* 9
  - *hexandra* 93
  - *lenticularis* 92
  - *monandra* 96
  - *oryzoides* 94
  - *virginica* 95
- Leptochloa 12
  - dubia 235
  - fascicularis 230
  - imbricata 232
  - *langloisii* 233
  - mucronata 237
  - nealleyi 234
  - pringlei 236
  - scabra 233
  - spicata 229
  - *stricta* 234
  - viscida 231
- Lepturus 14
  - *bolanderi* 315
- *Lesourdia karwinskyana* 243
  - *multiflora* 243
- Limnodia 11
  - arkansana 151
- Lolium 14
  - italicum 314
  - perenne 313
- *Lophochlæna refracta* 281
- Luziola 9
  - alabamensis 91
- Lycurus 11
- Manisuris 7
  - compressa 23
  - *granularis* 24
- MAYDEÆ 6
- Melica 13

Page.

- Melica bulbosa 279
  - *glabra* 275
  - mutica 275
  - pariviflora 276
  - *porteri* 276
  - spectabilis 277
  - stricta 278
- Milium 11
  - effusum 116
  - *lendigerum* 159
- Miscanthus 7
- Molinia 13
- Monanthochloë 13
  - littoralis 244
- Muhlenbergia 11
  - diffusa 117
  - filiculmis 126
  - *glomerata* 121
  - gracilis 129
  - gracillima 124
  - mexicana 118
  - porteri 123
  - pringlei 122
  - pungens 125
  - racemosa 121
  - schaffneri 127
  - sylvatica 120
  - tenuiflora 119
  - *texana* 123
  - virescens 128
  - *willdenovii* 119
- Munroa 13
  - squarrosa 245
- Nardus 14
  - stricta 312
- Nazia 8
- Oplismenus 9
- Orcuttia 13
  - californica 246
- Oryza sativa 9
- ORYZEÆ 9
- Oryzopsis 11
  - asperifolia 111
  - exigua 113
  - fimbriata 112
  - *kingii* 108

Page.

- Oryzopsis melanocarpa 110
  - *membranacea* 115
  - micrantha 114
  - mongolica 109
- PANICACEÆ 6
- PANICEÆ 8
- Panicularia 13
  - aquatica 298
  - canadensis 302
  - elongata 300
  - fluitans 303
  - nervata 299
  - pallida 301
- Panicum 9
  - amarum 73
  - anceps 71
  - barbulatum 77
  - boreale 76
  - bulbosum 74
  - colonum 81
  - columbianum 78
  - *corrugatum* 84
  - crus-galli 82
  - *dactylon* 189
  - demissum 79
  - filipes 68
  - gibbum 65
  - *glabrum* 55
  - gracillimum 57
  - grossarium 61
  - *hians* 66
  - lanatum 60
  - leucocomum 58
  - *leucophæum* 60
  - lineare 55
  - longipedunculatum 80
  - melicarium 66
  - *molle* 52
  - nashianum 79
  - obtusum 63
  - paspaloides 59
  - proliferum 69
  - repens 70
  - sanguinale 189
  - serotinum 56
  - sphærocarpon 75

Page.

- Panicum stenodes 64
  - texanum 62
  - verrucosum 67
  - virgatum 72
  - *viride* 83
- Pappophorum 13
  - apertum 240
  - *boreale* 239
  - wrightii 239
- Paspalum 9, 12
  - compressum 42
  - difforme 47
  - *digitaria* 41
  - dilatatum 49
  - distichum 43
  - *elliottii* 41
  - floridanum 48
  - læve 45
  - *ovatum* 49
  - paspaloides 41
  - *platycaule* 42
  - plicatulum 46
  - setaceum 44
- Pennisetum 9
  - setosum 89
- Pereilema 11
- PHALARIDEÆ 10
- Phalaris 10
  - amethystina 97
  - angusta 99
  - caroliniana 98
  - *erucæformis* 226
  - *intermedia* 98
- Pharus 9
- Phippsia 11
  - algida 136
- Phleum 11
  - pratense 132
  - *schœnoides* 131
- Phragmites 13
  - *communis* 247
  - vulgaris 247
- Pleuropogon 13
  - refractum 281
- *Pleuraphis rigida* 39
- Poa 13

Page.

- Poa alpina 290
  - *ambigua* 250
  - arida 295
  - brevifolia 294
  - buckleyana 296
  - chapmaniana 289
  - *ciliaris* 266
  - *conferta* 264
  - *elongata* 300
  - *glomerata* 264
  - *hypnoides* 263
  - kelloggii 292
  - *maritima* 304
  - pratensis 291
  - sylvestris 293
  - *tenuifolia* 296
- POACEÆ 9
- Polypogon 11
  - monspeliensis 150
- Puccinellia 13
  - maritima 304
- Redfieldia 13
  - flexuosa 256
- Reimaria 9
  - oligostachya 40
- *Rottbœllia* 7
  - *compressa* 23
- Saccharum 7
- Savastana 10
  - macrophylla 102
  - odorata 101
- Schedonnardus 12
  - paniculatus 211
  - *texanus* 211
- Scleropogon 13
  - brevifolius 243
- Scolochloa 13
- Scribneria 14
  - bolanderi 315
- Secale 14
- *Setaria* 9
  - *composita* 85
  - *corrugata* 84
  - *italica* 86
  - *viridis* 83
- Sieglingia 13

Page.

- *Sieglingia acuminata* 253
  - *albescens* 251
  - *americana* 255
  - *eragrostoides* 248
  - *nealleyi* 252
  - *pulchella* 254
- *Sorghum pauciflorum* 35
- Spartina 10, 12
  - cynosuroides 191
  - *densiflora* 194
  - *glabra* 195
  - *gouini* 194
  - gracilis 193
  - *juncea* 192
  - junciformis 194
  - patens 192
  - polystachya 190
  - stricta maritima 195
- Sporobolus 6, 11
  - airoides 145
  - argutus 146
  - asper 137
  - compressus 143
  - confusus 147
  - curtisii 142
  - floridanus 141
  - heterolepis 139
  - indicus 144
  - interruptus 140
  - longifolius 138
- *Stenochloa californica* 257
- Stenotaphrum 9
  - *americanum* 90
  - secundatum 90
- Stipa 11
  - kingii 108
  - *membranacea* 115
  - mongolica 109
  - spartea 107
- *Syntherisma linearis* 55
  - *serotina* 56
- *Thurberia* 11
  - *arkansana* 151
- *Trachynotia polystachya* 190

Page.

- Trachypogon 7
- *Tragus* 8
- Trichloris 12
  - blanchardiana 207
  - *fasciculata* 207
  - pluriflora 208
- *Tricuspis monstrosa* 243
- Triodia 13
  - acuminata 253
  - albescens 251
  - ambigua 250
  - eragrostoides 248
  - nealleyi 252
  - pulchella 254
  - texana 249
- Triplasis americana 255
- Tripsacum 7
  - dactyloides 19
- Trisetum 12
  - canescens 181
  - cernuum 182
  - elongatum 180
  - interruptum 180
  - montanum 179
  - palustre 177
  - subspicatum 178
- TRISTEGINEÆ 8
- Triticum 14
  - *repens* 316
- Uniola 13
  - *gracilis* 284
  - latifolia 282
  - laxa 284
  - paniculata 283
- *Vilfa arguta* 146
  - *rigens* 148
- Weingærtneria 12
- *Windsoria pallida* 301
- Zea 7
- Zizania 9
- Zizaniopsis 9
- Zoysia 8
- ZOYSIEÆ 8

NEW YORK
BOTANICAL GARDEN

BULLETIN NO. 8. Agros. 18.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

STUDIES

ON

AMERICAN GRASSES.

I. NEW OR LITTLE KNOWN GRASSES.
By F. LAMSON-SCRIBNER.
II. LEAF STRUCTURE OF JOUVEA AND OF ERAGROSTIS OBTUSIFLORA.
By MISS E. L. OGDEN.

ISSUED MAY 6, 1897.

1862 1889

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.

BULLETIN No. 8. Agros. 18.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

STUDIES
ON
AMERICAN GRASSES.

I. NEW OR LITTLE KNOWN GRASSES.
By F. LAMSON-SCRIBNER.

II. LEAF STRUCTURE OF JOUVEA AND OF ERAGROSTIS OBTUSIFLORA.
By MISS E. L. OGDEN.

ISSUED MAY 6, 1897.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.

LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., March 18, 1897.

SIR: I have the honor to transmit herewith and to recommend for publication as a bulletin of this Division two papers, one describing several new or little-known grasses, the second upon the Leaf Structure of *Jouvea* and of *Eragrostis obtusiflora* by the histologist of the Division. These are both technical papers, and, like Bulletin No. 4, may be entitled "Studies on American Grasses."

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.

I. New or Little Known Grasses. By F. Lamson-Scribner 5

II. Leaf Structure of Jouvea and of Eragrostis obtusiflora. By Miss E. L. Ogden 12

  Jouvea 12

  Eragrostis obtusiflora 17

ILLUSTRATIONS.

PLATES.

Page.
Pl. I. Poa turneri Scribn 22
II. Poa leibergii Scribn 22
III. Panicum leibergii Scribn 22
IV. Elymus brownii Scribn. & Smith 22
V. Eragrostis obtusiflora Scribn 22
VI. Sporobolus plumbeus Hemsl 22
VII. Muhlenbergia flaviseta Scribn 22
VIII. Leaf Structure of Jouvea and of Eragrostis obtusiflora 22
IX. Leaf Structure of Jouvea, Eragrostis obtusiflora, and Distichlis spicata. 22

FIGURES.

Fig. 1. Elymus flavescens Scribn. & Smith 9

STUDIES ON AMERICAN GRASSES.

I. NEW OR LITTLE KNOWN GRASSES.

By F. LAMSON-SCRIBNER.

In the investigations being carried on necessary to the preparation of the proposed "Handbook of North American Grasses," new species or species heretofore unidentified or incorrectly determined are met with in the collections of the National Herbarium or in those submitted for examination. As the early publication of such new species and revised determinations is desirable, it has been decided to publish such matter and other investigations of purely technical character involving original research as soon as sufficient material has accumulated to warrant such publication, and for such bulletins to continue the title of "STUDIES ON AMERICAN GRASSES."

In the present bulletin are included descriptions and illustrations of a number of new or little known species of grasses, including two from Mexico, collected during the past season, one by Dr. Edward Palmer, which is probably new, and one by Mr. C. G. Pringle: and an exhaustive study of the histological characters presented by the leaves of those remarkable grasses, *Jourea pilosa* and *Jourea straminea*, and of the peculiar and very well marked species of *Eragrostis* which is here described under the name of *E. obtusiflora*, upon the supposition that it is the same as the *Brizopyrum obtusiflorum* of Fournier.

Poa turneri Scribn. sp. nov. (Plate I). A stoloniferous and apparently diœcious grass, 4 to 7 dm. high, with soft, flat leaves, and more or less spreading and nodding panicles of rather large, compressed, 3- to 6-flowered spikelets. Culms smooth, more or less geniculate at the lower nodes; nodes dark olive-green or nearly black; sheaths striate, smooth; leaf blade 10 to 15 cm. long, 5 to 6 mm. wide, acute, scabrous near the apex, and sometimes sparingly pilose on the upper surface near the base, otherwise smooth; ligule hyaline, 5 to 6 mm. long, rounded at the apex. Panicle 8 to 15 cm. long, the slender branches in threes or fives (rarely in twos), flower-bearing above the middle, naked below, the longer lower ones 5 to 10 cm. long. Spikelets about 7 mm. long, ovate, 3- to 6-flowered, glumes lanceolate, acuminate, the outer ones subequal, very acute, scarious on the margins, 3-nerved, about equaling the nearest flowering glumes; flowering glumes 5-nerved, scabrous on the keel near the acute apex, densely pilose on the keel and marginal nerves below, with a copious tuft of long, cobwebby hairs at the base, scabrous between the nerves above, more or less pubescent between the nerves below in the fertile spikelets, margins scarious; palea a little shorter than the glume, ciliate on the keel, and in the fertile spikelets pubescent between the nerves.

No. 65, L. Stejneger, Kurile Islands, August 22, 1896. Fertile plants of this species are represented in the National Herbarium by Nos. 1185, 1200, and a part of No. 1206, L. M. Turner, collected on Atka Island, Alaska, in July, 1880, reported to be common.

This species is very closely related to *P. hispidula* Vasey, but may be distinguished by its more open and lax panicle, its larger spikelets, which are usually 4- to 5-flowered, and by its longer, narrower, and more acute glumes, both the outer ones being 3-nerved and nearly or quite as long as the nearest floral glumes.

Poa leibergii Scribn. sp. nov. (Plate II). A densely cæspitose, fibrous-rooted, glabrous perennial, with crowded basal leaves 1 to 5 cm. long, slender, scape-like culms .5 to 1.5 dm. high, and few-flowered, simple panicles; base of the culms densely clothed with loose scarious sheaths. Innovations intravaginal. Culm leaf one, hardly appearing above the leaves of the innovations; ligule very delicate, hyaline, about 2 mm. long; leaf blade about 1 mm. wide, 2 to 4 cm. long, that of the culm 1 to 2 cm. long, conduplicate when dry, minutely scabrous along the margins and at the apex, otherwise smooth. Panicles bearing 3 to 7 spikelets, or sometimes reduced to a single spikelet. Lower branches usually in pairs, minutely scabrous, each branch bearing a single spikelet. Spikelets 2- to 3-flowered, 5 to 6 mm. long, rather broadly ovate; outer glumes somewhat unequal, the first broadly lanceolate, 1-nerved and subacute, the second much broader than the first, 3-nerved, and varying from subacute to broadly truncate at the erose-dentate apex; flowering glumes glabrous, the first 4 to 5 mm. long, somewhat exceeding the outer glumes, distinctly 5-nerved, obtuse and erose-dentate at the scarious apex; palea a little shorter than the glume, ciliate-scabrous on the keels excepting near the base.

Collected on the summits of the ridges which form the northwestern angle of the barren valley, Malheur County, Oregon—the Owyhee-Malheur Divide, altitude 1,250 m., No. 2171, John B. Leiberg, May 31, 1896.

Regarding this grass Mr. Leiberg says: "It grows in medium-sized, extremely tufted, and densely matted patches, occurring rather sparingly in open, turfy places in the Juniper timber, especially upon depressed areas which hold water during a few weeks in early summer."

This species is at once distinguished from *Poa pattersoni* by its fewer-flowered panicles and glabrous flowering glumes. The alpine *Poa lettermani* Vasey has a habit of growth somewhat similar, and glabrous flowering glumes, but the spikelets are hardly more than half as large, and the outer glumes exceed the flowering glumes in length. It does not possess the long, scape-like culm of the species here described. *Poa pringlei* is a more rigid grass, with short, creeping rootstocks, shorter culm leaves, and larger spikelets, the flowering glumes being much firmer in texture and distinctly scabrous, especially near the apex.

Panicum leibergii Scribn. (Plate III). (*Panicum scoparium leibergii* Vasey, Contr. U. S. Natl. Herb., Vol. 3, 31.) (*Panicum scribnerianum leibergii* Scribn. Bull. 6, Div. Agros. 32; 1897.)—A slender, erect or ascending perennial 3 to 6 dm. high, with rather broad, flat leaves, and few-flowered panicles of comparatively large, obtuse spikelets. Culms strongly scabrous, especially near the nodes, often geniculate at the base, finally much branched, branches erect; sheaths rather loose, striate, papillate-pilose to hirsute, with rather long spreading hairs, the papillæ lying between the striæ, ciliate on the margins near the throat; ligule a very narrow and minutely ciliate ring, almost obsolete; leaf blades of the primary culms about 10 cm. long and 1.5 cm. wide (those of the branches somewhat smaller and narrower), with 9 to 11 nerves, lanceolate-acute, clasping at the rounded or subcordate base, conspicuously papillate-pilose on the lower surface, sparingly so above, rough scabrous on the upper surface and along the very narrow, cartilaginous margins, which are also more or less conspicuously ciliate. Panicle ovate-oblong, 5 to 7 cm. long, sparingly branched, the scabrous branches more or less spreading, bearing 1 to 3 spikelets. Spikelets oblong, obtuse, 3 to 4 mm. long; the outer glumes papillate-pilose with rather stiff spreading hairs like those of the sheaths, only somewhat longer; first glume broadly ovate, subacute, 3-nerved, one-third to one-half as long as the second; second glume a little longer than the fourth, rounded, obtuse, 7- to 9-nerved; third glume similar to the second, 9-nerved, with a subhyaline palea nearly as long as itself, and usually inclosing a staminate flower; fourth or fruiting glume smooth and shining, obtuse, marked with a transverse fold or crease on the back, near the base. The panicle branches become strict with age.

Missouri, Iowa, Minnesota, South Dakota, Nebraska. The type specimens were collected by John B. Leiberg, in Plymouth County, Iowa, 1878. Other specimens in the National Herbarium are: From Minnesota, No. 3, L. R. Moyer, Chippewa County, June, 1894; Acton, Mercer County, June, 1892, collected by W. D. Frost. Iowa, No. 69 B. Shimek, May 9, 1895, Johnson County. Missouri, Nos. 730 and 744 B. F. Bush, Shannon County, May 15, 1894. Nebraska, No. 2523 Fred. Clements, Ponca, June 13, 1893. South Dakota, No. 12 Thomas A. Williams, Brookings, July, 1891, also E. N. Wilcox, No. 16, 16*a*, 1896. One sheet in the National Herbarium, marked "Stevens Pacific Railroad Expedition, 5 miles above Sonora," contains this species.

As in several species of the group to which this belongs, there is a smooth ring just below the nodes; below this the culms are very strongly scabrous. This species may be distinguished from *Panicum pauciflorum* Ell., by its scabrous culms, not, as in that species, more or less pubescent, by having the sheaths, leaves, and spikelets papillate-pilose; by its broader leaves and fewer-flowered and more simple panicles. *Panicum scoparium* Lam., as understood by the writer, is a much stouter plant with hairy culms, bearded nodes, and leaves softly pubescent beneath. *Panicum scribnerianum* Nash, differs from *Panicum leibergii* in having pubescent culms and more broadly ovate, glabrous, or very minutely pubescent spikelets, the first glume of which is much shorter and broader in proportion to its length.

Elymus brownii Scribn. & J. G. Smith, sp. nov. (Plate IV). (*Elymus mollis* R. Br., Richardson in Franklin Narr., First Voy., p. 732 [1823], not Trin.) A somewhat rigid, but rather slender, erect perennial 5 to 9 dm. high, with short cauline leaves and densely flowered spikes 4 to 10 cm. long. Rootstock creeping. Culms smooth, occasionally glaucous, and often slightly pubescent just below the nodes; sheaths striate, smooth; ligule very short, hardly 0.5 mm. long; leaf blades rather rigid, those of the innovations erect, 10 to 18 cm. long, 2 to 5 mm. wide, scabrous on the margins and nerves beneath, smooth above, very acute and somewhat pungent-pointed; cauline leaves erect or ascending, 5 to 12 cm. long, 4 to 8 mm. wide, very acute. Spikelets 3- to 6-flowered, 10 to 15 mm. long; outer glumes linear-subulate from the base, short awnpointed, nearly as long as or much shorter than the spikelets, scabrous or minutely pubescent toward the base; flowering glumes rounded on the back, densely pubescent or subvillous, short awnpointed; first flowering glume 8 to 10 mm. long; awns 2 to 4 mm long; palea nealy as long as the glume, 2-toothed, finely ciliate on the keels above.

Black Hills of South Dakota, British Columbia, and northward to Alaska. This species is represented in the National Herbarium by specimens collected by Prof. John Macoun, Bow River Pass, No. 107, September 13, 1879, also on the Saskatchewan Plains, No. 72, August 22, 1872; George W. Dawson, Dease Lake, lat. 58°, No. 103, June 23, 1887; Mr. James Macoun, Kicking Horse Lake, British Columbia, No. 43, August 16, 1890, altitude 5,000 feet and gravelly banks, Severn River, Keewatin, July 29, 1886; 1178, P. A. Rydberg, June, 1892, Elk Canyon, South Dakota; William M. Canby, Rocky Mountains, near Banff, Canada, July 19, 1895. It is from this specimen that the plate illustrating this species has been drawn. English River, Saskatchewan; there is no further data attached to this specimen.

This species is closely related to *E. dasystachys* Trin., a specimen of which, from the Botanical Museum of the Imperial Academy of St. Petersburg, is in the National Herbarium, but is easily distinguished by the outer glumes. In *E. dasystachys* Trin., the outer glumes are as long as the spikelet, distinctly flattened, and smooth and shining on the back. In *E. brownii* the outer glumes are irregular in length, usually much shorter than the spikelet, terete or subulate from the very base, and are distinctly scabrous throughout and sometimes even pubescent near the base. In the closely allied *E. junceus* Fisch., the flowering glumes are prominently nerved, while in *E. brownii* the nerves are not visible from the back.

Elymus flavescens, Scribner & J. G. Smith, sp., nov. (Fig. 1). A stout, erect perennial 6 to 10 dm. high, from long, creeping rootstocks, with very long, somewhat rigid leaves, and rather loosely-flowered, straw-colored spikes 10 to 20 cm. long. Culms glabrous, usually pubescent just below the nodes. Sheaths striate, glabrous, often somewhat glaucous, the lowermost becoming loose and fibrous; ligule very short, scarious, distinctly auricled; leaf blades 20 to 40 cm. long, 4 to 8 mm. wide, linear, smooth below, strongly scabrous or strigose-pubescent above, gradually tapering to the very acute, pungent tips. Spike linear or lanceolate, often branching, forming a spikelike panicle; axis and pedicels more or less silky-villous. Spikelets somewhat compressed, 3- to 6-flowered, 1 to 2 cm. long, densely villous with rather long whitish or yellowish hairs; outer glumes lanceolate or linear-lanceolate, the second usually a little broader than the first, more or less pubescent or silky-villous on the back, subaristate-point d, about equaling the nearest flowering glume; flowering glumes broadly lanceolate, ovate, very acute, mucronate or subaristate-pointed, margins scarious, very densely silky-villous on the back with flavescent and more or less spreading hairs, which are 2 to 3 mm. long; first flowering glume about 10 to 12 mm. long; palea much narrower and about two-thirds the length of the glume, bifid at the apex, scabrous along the keel above, pubescent below the lowermost and uppermost spikelets often imperfect.

The habit of growth of this species resembles that of *Elymus arenarius*, but it is a much more slender grass, with longer, more slender spikes, which are frequently branched, becoming simple, spikelike panicles, and the spikes are conspicuous by their pale yellow or whitish color and densely silky-villous spikelets. More closely still does its habit of growth and inflorescence resemble *E. dasystachys littoralis* Griseb., but in that grass the outer glumes are glabrous and the floral glumes are pubescent, not silky-villous. In American herbaria this species has been referred to *E. mollis* Brown and to *E. dasystachys* Trin.

Dry, sandy grounds and drifting sand dunes, Idaho to Oregon and Washington, June. This species is represented in the National Herbarium by the following specimens: 916 W. N. Suksdorf, June 11, 1886, Columbus, Klickitat County, Washington; 257 E. Palmer, June 30, 1892, Blackfoot, Idaho; Thomas J. Howell, June 11, 1881, near the Dalles, Oregon, and one specimen from the Wilkes Exploring Expedition, without locality.

Elymus dasystachys littoralis Griseb. in Ledeb. Flor. Ross. **4**, 333. (*Elymus littoralis* Turcz.) A rather stout and somewhat rigid, erect perennial 8 to 10 dm. high from extensively creeping rootstocks, with long, pungently pointed, narrow leaves, and rather loosely flowered and often branched spikes 20 to 30 cm. long; axis pubescent. Culms glabrous, the lowermost nodes covered by loose, scarious, and sometimes bladeless sheaths. Sheaths, excepting the basal ones, strongly striate, glabrous; ligule very short, minutely ciliate, usually strongly auriculate; auricles, when present, cymbiform; leaf blades 20 to 40 cm. long, 3 to 5 mm. wide, glabrous beneath, strongly strigose-pubescent above, very long-acuminate-pointed, becoming involute. Spikelets 5- to 9-flowered, solitary, in pairs, or sometimes raised upon short branches, the spike becoming a narrow panicle. Outer glumes narrowly lanceolate, the second usually a little broader than the first, scabrous along the keel, especially toward the rigid, subulate apex, rarely somewhat pubescent near the base, usually about one-fourth shorter than the nearest flowering glumes; flowering glumes 12 to 15 mm. long, lanceolate, very acute or subaristate-pointed, 5-nerved, margins scarious, rather densely pubescent on the back for nearly two-thirds the length, the upper third glabrous; palea nearly as long as the glume, minutely ciliate on the keels near the apex; joints of the rachilla densely pubescent.

Idaho and Washington. This species is represented in the National Herbarium by No. 466 Sandberg and Leiberg, Washington, collection of 1893; No. 356 E. Palmer, collected at Idaho Falls, Idaho, July, 1893.

In habit this grass very closely resembles *Elymus flavescens* Scribn. & Smith, having similar creeping rootstocks, long leaves and elongated, often branching spikes. It may at once be distinguished, however, by having the flowering glumes clothed merely with a short and appressed pubescence, while in *E. flavescens* the flowering glumes are densely villous with rather long, usually yellowish and spreading hairs. A grass which corresponds very well with the description of *E. dasystachys*, differing from the var. *littoralis* here described in its broader leaves, shorter spikelets, rather narrower and proportionately longer empty glumes and with flowering glumes pubescent nearly to the tips, is represented in the National Herbarium by No. 1176, W. N. Suksdorf, collected near Rockland, Klickitat County, Washington, July 3, 1890. A closely related form, evidently belonging to this species and possibly referable to var. *asper* of Regel, distinguished by its less distinctly creeping rootstocks, shorter leaves which are not strigose-pubescent above, shorter spikes and fewer-flowered spikelets, which have the flowering glumes pubescent quite to the apex, is represented by specimens in the National Herbarium, collected at Pen Gulch, Colorado, by Prof. J. W. Letterman, August, 1885, and by Dr. George Vasey at the same locality, August, 1884. This form has some characters in common with *E. angustus*, but differs from the grass referred to that species in Bulletin No. 4, p. 38, in its awnless glumes and more rigid spikes. *E. angustus* may at once be distinguished from any form of *E. dasystachys* by its fewer-flowered spikelets, these being 2- to 3-flowered, while in *E. dasystachys* they are 4- to 9-flowered.

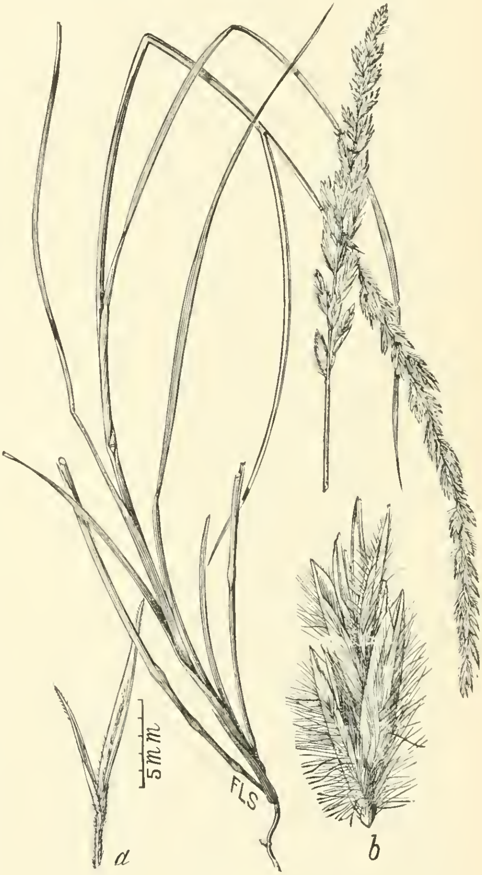


FIG. 1.—*Elymus flavescens* Scribn. & Smith.

A comparison of the North American species of *Elymus* of this group with types of published species or with authentically named material is greatly to be desired, and is in fact necessary to the positive identification of the species.

Eragrostis obtusiflora Scribn. (*Brizopyrum obtusiflorum* Fourn.?) (Plate V.) A rigid, glaucous perennial, 3 to 5 dm. high, with strong, creeping rootstocks, stiff, pungent-pointed leaves, and more or less spreading panicles 8 to 14 cm. long. Scales of the stout rootstocks closely imbricated Sheaths striate, sparingly pilose at the throat, covering the internodes; ligule very short, ciliate; leaf blades erect-spreading, about 4 mm. wide at the base, convolute toward the cartilaginous apex, minutely scabrous above, smooth beneath. Panicle-branches erect or somewhat spreading, sharply triangular, minutely scabrous, the lower branches 5 to 7 cm. long. Spikelets 5- to 12-flowered, 7 to 15 mm. long, lanceolate, the florets rather crowded; empty glumes ovate-acute, somewhat compressed, 1-nerved, the smaller, lower one two-thirds the length of the first floret; flowering glumes broadly ovate, obtuse or subacute, rounded on the back, strongly 3-nerved, firm-membranaceous, smooth; palea broadly 2-keeled, minutely scabrous on the keels, about the length of the glume.

No. 193 Wright (collection of the Mexican Boundary Survey under Maj. W. H. Emory), on the margins of Laguna de Sta. Maria. Sulphur Springs Valley, Arizona, Prof. J. W. Tonmey, September 26, 1896.

Dr. Thurber, in his manuscript notes upon the grasses of the Mexican Boundary Survey, doubtfully referred this species to Glyceria, but its distinctly 3-nerved flowering glumes at once separate it from that genus. The habit of growth suggests a relationship with *Distichlis* and also with *Jouvea.* The nervation of the glumes at once distinguishes it from *Distichlis,* while the character of the inflorescence and the hermaphrodite spikelets clearly separate it from *Jouvea.*

"This species is one of the most abundant grasses in the extreme alkaline portions of Sulphur Springs Valley, where the large rootstocks in many places bind the shifting sands. It rarely flowers, and its superficial appearance, without flowers, is much the same as our common salt grass (*Distichlis spicata*). It is a hard, rigid grass, but furnishes a large part of the forage of Sulphur Springs Valley, when other grasses are eaten off or are cut short by drought." (Professor Toumey.)

Sporobolus plumbeus (Trin.) Hemsl. (Plate VI). *Vilfa plumbea* Trin., Agrost. I:76, not Fourn.) A diffusely branching, leafy perennial 2 to 3 dm. high, with creeping rhizomes and spreading, rather few-flowered panicles 5 to 9 cm. long. Leaves crowded below. Sheaths loose, somewhat compressed, striate with scarious margins; ligule very short, hyaline, decurrent; leaf blades 3 to 7 cm. long, about 2 mm. wide, acute, minutely scabrous on the margins, especially near the tips, otherwise smooth. Panicle-branches more or less spreading, solitary, 1 to 5 cm. long, naked below the middle. Spikelets 3 mm. long, ovate, subacute; outer glumes subequal, rounded obtuse, second one sometimes broadly truncate, nerveless, about half the length of the flowering glume; flowering glume broadly·lanceolate, 3-nerved, subacute or submucronate pointed, minutely scabrous toward the apex; palea somewhat broader than the floral glume, about equaling it in length, minutely scabrous near the tip. Mexico, No. 6617 C. G. Pringle, 1896.

Mr. Pringle's specimens agree so nearly with Trinius, characters of his *Vilfa plumbea*, that it seems almost certain they belong to that species. I have not, however, been able to compare them with the type specimens. Trinius describes *Vilfa plumbea* as having panicles 2 inches long, the solitary branches naked below from the middle, the spikelets a line long and glabrous, with the leaves 1 to 1½ inches long and about a line wide. In Pringle's specimens the spikelets are 1½ lines long, and both the flowering glume and palea minutely scabrous toward the apex. The leaves are from 1 to 3 inches long. But this difference in size may result from the specimens being of more vigorous growth than those seen by Trinius, and will not warrant the separation of the species without a comparison with the type.

Muhlenbergia flaviseta Scribn. sp. nov. (Plate VII). A slender, erect, glabrous perennial, with simple, scape-like culms 2 to 3 dm. high, short, creeping rootstocks, flat leaves which are crowded at the base, and terminal, rather densely-flowered panicles 2 to 6 cm. long. Leaves of the culm 2 to 3, hardly exceeding those of the innovations. Sheaths striate, glabrous, longer than the internodes; ligule very short, ciliate, decurrent; leaf blades 5 to 10 cm. long, the uppermost 1 to 2 cm. long, 2 to 4 mm. wide, gradually tapering from the base to the long attenuate-pointed, scabrous tips, scabrous on the margins and strongly scabrous on the upper surface. Panicle branches solitary, compound, naked below, more or less spreading in anthesis, scabrous, as are the very short pedicels. Spikelets 3 to 4 mm. long exclusive of the awns; outer glumes thin and somewhat scarious, very unequal, the first one-fourth to nearly one-half the length of the second, which is 2 to 3 mm. long, oblong-lanceolate and subacute, the apex being minutely ciliate with a few short hairs; flowering glume narrowly lanceolate, 3-nerved, minutely scabrous on the midnerve above, very shortly and minutely barbate at the base; palea a little shorter than the glume, scabrous near the acute tip. Awn yellow, 15 to 18 mm. long, arcuate or flexuose, minutely scabrous. No. 834, E. Palmer, Mexico, 1896.

This rather showy species is related to *Muhlenbergia gracilis*, from which, however, it is readily distinguished by its much more slender and scape-like culms, shorter panicle, and yellow, flexuose awns.

"This grass was found at Dos Cajetes, 30 miles nearly west from Durango, on the road to Otinapa, altitude 8,500 feet, among pines and oaks, October 23, 1896. Many plants grew together along the slopes of ravines. The color of the tops gives a very showy appearance, distinguishing the grass from everything around it. But the animals did not appear to like it, because it was noticed that none of the tops had been eaten off. It is a very abundant grass." (E. Palmer.)

II. LEAF STRUCTURE OF JOUVEA AND OF ERAGROSTIS OBTUSIFLORA.

(Plates VIII and IX.)

By Miss E. L. Ogden.

JOUVEA.

Two species of the genus *Jouvea* have been distinguished—*J. pilosa* (Presl.) Scribn. and *J. straminea* Fourn. In the former species no distinction can be made in habit or in character of leaves between ♀ and ♂ plants, and to these the ♂ plant of *J. straminea* bears a close resemblance. Their leaves are rigid, closely conduplicate throughout their entire length, and terminate in a sharp, thorn-like point. The ♂ plant of *J. straminea*, which is perhaps not identified beyond the possibility of a doubt,[1] usually has smaller and less rigid leaves than those of the other species, yet in respect both to size and rigidity the leaves of all vary within wide limits, and render this distinction of little importance. In *J. straminea* the plants of different sex are strikingly unlike. The pistillate plant is slender with long, soft leaves that are flat for the greater part of their length and slightly involute only toward the apex.

The points of resemblance presented by plants of different species as well as the marked difference between the plants of different sex of the species *straminea* render a close examination of their structure of much interest. It is, furthermore, of much interest to compare with *Jouvea*, the leaf structure of *Eragrostis obtusiflora* (Fourn.) Scribn., a peculiar grass of the same region, which was at first suspected to be a new species of the genus in question. And since *Jouvea* itself has been referred to *Distichlis*, a comparative study is added of *D. spicata* (Linn.) Greene, as a representative of the latter genus.

These plants are all inhabitants of dry regions. *Jouvea* and *Eragrostis obtusiflora* belong to the sandy deserts of Arizona and Mexico, while *D. spicata* has a wider distribution. They may therefore be expected to show similarity in all characters of structure that are especially affected by conditions of climate and soil. At the same time plants of the same species growing under different conditions will vary much in regard to the presence and state of development of structures upon which ability to resist drought depends.

From an anatomical point of view the leaf of *Jouvea pilosa* is interesting both on account of its individual peculiarities and on account of the differences in structure that accompany the outward changes of form and texture from base to apex. The lower part of the blade is inclined to be involute rather than conduplicate, but the central portion is closely conduplicate when dry (probably always so) and the leaf thence tapers to a sharp, rigid, thorn-like apex.

---

[1] Bull. Torr. Bot. Club., Vol. XXIII, No. 4, April, 1896, Grass Notes by F. Lamson-Scribner.

A basal transverse section of a leaf of the ♀ plant of *J. pilosa* (fig. 1, Pl. VIII) has a slightly curved form in accordance with the involute character of the leaf at this point. The midrib differs from the other large veins only in the greater quantity of hypodermal fiber that accompanies it on the lower face. The upper face of the leaf has deep narrow furrows with rounded or nearly square ridges intervening. The lower face has no furrows but is sometimes slightly undulate.

On the upper leaf surface the band of epidermis covering the fibrous tissue at the summit of each ridge is composed of several rows of alternately long and short cells interrupted by numerous, thick-walled unicellular prickles. At each side of this band are several rows of cells (figs. 1 and 2, *a*, Pl. VIII) that cover the sides of the ridges and border immediately on chlorophyll-bearing parenchyma. They have numerous exodermal expansions that take the form of bluntly conical or somewhat capitate projections of some portion of the outer walls of the rectangular cells. These protuberances are often irregularly grouped around the stomata (fig. 1, *st.*, Pl. VIII) which occur in one or more longitudinal rows on each side of the ridges. Short, nearly spherical, two-celled hairs occur in the rows of cells marking the border between the first and second named bands of the epidermis. The long unicellular hairs that cover the inner surface of the leaf at its base spring from circular mound-like groups of deep and narrow colorless cells. These occur among the bulliform cells and at the margins of the leaf. Owing to the depth of the furrows, a surface view of the bulliform cells is difficult to obtain, but a transverse section (fig. 1, B, Pl. VIII) shows them to be in from three to five rows at the base of each furrow. The lateral ones are not distinctly different from other epidermal cells.

On the lower surface the epidermal cells (fig. 1, *b*, Pl. VIII) covering the bands of hypodermal fiber are narrower than those over the other tissues. They are bordered on each side by one row of cells interrupted by stomata. The epidermal cells covering the colorless cells between the veins are in several rows and are wider than those over the fiber bands. Their walls are undulate, and long and short cells alternate. In transverse section the epidermal cells of the lower face are remarkable for their large cavities. Although those covering the fiber bands are smaller than the others, yet throughout the leaf and even at the tip which consists wholly of sclerenchymatous fiber (fig. 5, Pl. VIII), the large lumina of the epidermal cells are conspicuous. Their outer walls are thickened and the surface of the leaf is very smooth and even. In the median portion of the leaf there are no exodermal expansions, but near its base small prickle-shaped expansions and two-celled hairs occur. Stomata are numerous over the chlorophyll tissue and are unprotected. They are not all depressed below the surface of the leaf, and the guard cells are covered with cuticle that is only half as thick as that over the other epidermal cells.

The arrangement of chlorophyll-bearing cells is concentric with respect to each fibro-vascular bundle, and each bundle with its encircling rows of chlorophyll-bearing cells is entirely separated from the adjacent concentric systems by bands of colorless parenchyma that extend from the bulliform cells above to the large epidermal cells below.

The fibro-vascular bundles of the primary order have an unbroken sheath of from one to several rows of cells. The sheath cells below the bundle are often in two or more rows and have a small excentric lumen and very thick walls. The upper cells sometimes have comparatively large central cavities and thin walls, and again are like the lower cells. In the lower cells the lamination of the cell walls and the radial canals through them are conspicuous. Bundles of the secondary order (one to three of which intervene between two primary ones) have no large oval vessels and no definite line between xylem and phloëm. Their sheath is of a single row of thick-walled cells below the bundle and sometimes on the sides, but above it is replaced by a group of thin-walled, large-lumened cells, which, together with the bundle, assumes a sharply oval or pear-shaped form. In longitudinal section the length of these cells is from 1½ to 3 times their diameter. The transverse walls are oblique and the ends overlap. The walls are often delicately pitted. Every bundle is encircled by a ring of chlorophyll-bearing cells (fig. 1, *ch*, Pl. VIII) that are flattened on the sides next each other and toward the bundle, but are convex on the outer side of the ring. Separation of these cells by maceration proves that they are closely coherent in longitudinal rows and that the convex wall (fig. 10, *ch*, Pl. IX) is of such uneven thickness that it may be said to be either deeply pitted or reticulately thickened, while the other walls show neither pits nor reticulate markings, though they are very firm in contrast to the delicate cell walls of the rest of the chlorophyll-bearing tissue. This last, like that of nearly all grasses whose tissues have a similar concentric arrangement, is composed chiefly of cells whose long axis is parallel with that of the leaf and at least two of whose sides are marked with deep regular incisions that are opposite each other and divide the cell into regular lobes (fig. 10, *l b*, Pl. IX). The greatest width of the cell in a direction radial with respect to the bundle is several times greater than the width in a tangential direction, so that in cross section the cells seem to be radially arranged about the inner ring of pitted chlorophyll bearing cells. This arrangement is very clearly seen in bleached sections (fig. 9, Pl. IX). The bands of colorless parenchyma (fig. 1, *c p*, Pl. VIII) between the ridges consist of one or more rows of large, thin-walled cells which at the lower surface of the leaf expand into a width of three or four cells and at the upper surface terminate in a group of bulliform cells.

The quantity and nature of hypodermal fiber varies much in different leaves. It always occurs, however, below all bundles in one or more rows of cells and in several rows at the margin of the leaf and, except below the midnerve, is separated from the bundles by chlorophyll-bearing parenchyma. Hypodermal fiber above the bundles is represented by cells which are small in diameter and have relatively large cavities, but whose walls are firm (fig. 1, *h*, Pl. VIII). The cells next to the epidermis are usually more open, while the interior ones more nearly approach ordinary fiber in character. The diameter of these cells and the thickness of their walls vary considerably in different leaves, and sometimes the tissue approaches colorless parenchyma rather than fiber in appearance. Hypodermal fiber below the bundles and at the margins usually shows an inner cellulose layer that almost fills the cells, so that the cavity is sometimes barely distinguishable. In less rigid leaves fiber below the bundles as well as that above is of large-lumened cells, and variation in this respect is great. This is also true of the leaves of the staminate plant.

A median section (fig. 2, Pl. VIII) has the V-shape usual to conduplicate leaves (compare fig. 3, Pl. VIII). The leaf is thicker here, and the ridges are consequently higher than in the basal section. The superior epidermis and the arrangement and character of the chlorophyll tissue is the same as in the lower part of the leaf. The midrib is narrower and very acute, and the lateral ridges also assume a triangular shape. The bulliform cells are usually larger, and the bundles are all oval. In the primary bundles all the cells of the sheath, including those above the bundle, have very thick walls. Less fully developed bundles have two oval vessels, and the phloëm is separated from the chlorophyll tissue by a row of sheath cells similar to those in the largest bundles. The large-lumened, thin-walled cells are inclosed by the ring of pitted chlorophyll-bearing cells. Their number and the thickness of their walls vary with the thickness and rigidity of the leaf. The bands of colorless parenchyma between the ridges are not continuous from one face of the leaf to the other, but are interrupted by a strand of fiber (fig. 4, *h*, Pl. VIII) that is next the epidermis of the lower face and occupies the space that, in the basal section, is filled by very thin-walled, large-lumened, colorless, parenchyma cells. The thickness of this fibrous strand varies much in different leaves. It is sometimes represented by two or three small cells with slightly thickened walls, and sometimes it forms a wide band of very strong fibrous cells occupying a third of the thickness of the leaf. The character of the fibrous cells is usually more uniform in a median than in a basal section, although the cells on the upper surface still show larger cavities than those below. From the middle to the apex of the leaf the sections show successively fewer and narrower ridges, and fibrous masses grow thicker beneath the colorless parenchyma while they decrease under the bundles. The form of the section becomes more and more closed until near the apex it assumes a palette or a cirular shape (fig. 5, Pl. VIII). Here the center consists of a few large cells with scanty chlorophyll contents, but the rest is occupied by thickened cells of various sizes, all, however, with distinct lamination and conspicuous radial canals. As long as chlorophyll tissue appears near the surface, even in the thorn-like tip, stomata are to be found in the outer epidermis.

The ♂ plant of *J. straminea* does not differ much from that of *J. pilosa*, except that it is smaller and less rigid. Anatomical differences are not more pronounced. The fibrous tissue is very slightly developed; the cells are few and their walls thin, even in the strand at the margin of the leaf, and the strands under and above the bundles are reduced to one or two cells. The ♀ plant, on the other hand, is widely different from the ♂ plant of the same species. When dry, the leaves are flat except at the apex, which is somewhat involutely folded. They are less rigid than those of the staminate plant, and the apex is not pungently pointed. One or two young leaves, however, at the apex of each shoot are conduplicate, and are curved backward as in the male plant. The transverse section of one of these reveals the presence of ridges and furrows, and the bulliform cells are much smaller than those of older leaves of the same shoot. This difference is wholly due to the undeveloped condition of the bulliform cells consequent on the immaturity of the leaf. The flat leaves have usually one or two nerves of one margin folded inward for the whole length of the leaf, and it is this bend that, by bringing the margins close together, is chiefly responsible for the involute or conduplicate folding of the leaf at its apex.

A transverse section (fig. 6, Pl. IX) shows that the veins do not form ridges, but are, on the contrary, often depressed below the level of the bands of prominent bulliform cells. The veins of the basal portion of the leaf are covered for a short distance with numerous prickles. With the exception of these and of a few others sparsely scattered along the nerves and margins, the upper epidermis has no exodermal expansions proper, though the club-shaped cells that cover the chlorophyll parenchyma overlap in such a way as to make the larger end of the cell somewhat prominent. It is chiefly remarkable for the size and number of bulliform cells (fig. 6, B, Pl. IX), which are arranged in from 5 to 7 rows, the central one being very acute at the summit and very broad at the base, the lateral cells (fig. 6, *b*, Pl. IX) narrow and deep and projecting far beyond the stomata which border them, so that in surface view the latter are almost hidden. A longitudinal section shows that the length of the bulliform cells is never as great as their depth, and also that the underlying colorless cells are two or three times as long as the bulliform cells. Toward the apex of the leaf there are a few prickles along the nerve that marks the marginal fold; otherwise the lower epidermis has no exodermal expansions, though its cells are less regular than those of the male plant. Bands of colorless parenchyma extend in one row of cells from the bulliform cells to the opposite face of the leaf and are never interrupted below by hypodermal fiber. Fiber is present at the margin of the leaf and there are a few fiber-cells, often only one or two, above and below each bundle. The cells are thick-walled with scarcely distinguishable cavities. The large bundles are like those of *Distichlis spicata.* They differ from those of the male plant in having not only a band of sheath cells dividing the xylem from the phloëm, but also almost invariably a band of several rows of the same cells dividing the phloëm into two parts. Also there is a sheath of one row of cells that are thick-walled around the sieve portion of the bundle, but thin-walled above the xylem.

ERAGROSTIS OBTUSIFLORA.

In this grass the leaves are more slender and less rigid than those of *Jouvea pilosa*, but sections from different parts of a leaf show the same variations of general form, the basal section being curved and the median V-shaped (figs. 3 and 4, Pl. VIII). The apical section differs from the median in degree only and not in form. The presence of ridges and furrows on the upper face, the shape of the bundles, and the general character of the bands of hypodermal fiber (fig. 7, Pl. IX) are like those of *Jouvea pilosa*, as is also the concentric arrangement of the tissues, and the bands of colorless parenchyma between the bundles. The lower surface of the leaf is slightly furrowed. Long pilose hairs and two-celled hairs are altogether wanting or are rare on the upper surface, but otherwise the exodermal expansions are as in *J. pilosa.* The epidermis of the lower face differs in that the cells covering colorless parenchyma are very irregular in form and in the thickness of the walls. These cells frequently have curved beak-like expansions that project over the stomata; their walls are very unevenly thickened and show many radial canals. They are frequently interrupted by glandular bodies that have a spherical hypodermal portion, a narrow neck, and a capitate exodermal portion. Similar glands occur in the superior epidermis on the sides of the ridges. The epidermal cells are all very small in transverse section. In a basal section primary and secondary bundles occur in regular alternation, but in a median section two or three secondary ones intervene between two primary. The primary bundles differ slightly from those of a corresponding section of *J. pilosa* in that a row of thickened cells separates xylem from phloëm. The secondary bundles differ in the marked line between xylem and phloëm and also in the nature of the sheath. This consists of a single row of cells. Below and above the bundle these have relatively smaller cavities and thicker walls than the corresponding cells of *J. pilosa*, but frequently on either side of the bundle there occurs one cell much larger than the others, of more angular shape, and in almost any section taken at random a transverse, pitted wall is conspicuous. The two uppermost cells of the inner chlorophyll-bearing ring are at least twice as large as the other cells of the ring, and are usually wedge-shaped with the narrow end turned toward the bundle. They are either more liable to lose their contents in cutting or else are less abundantly filled, so that they often resemble colorless parenchyma. No large, thin-walled cells are enclosed by the chlorophyll ring, but on the other hand large groups of these cells occupy the whole summit of each ridge from one side to the other and from the round chlorophyll cells to the fiber above. The central colorless cells of each ridge are much larger than those that underlie the epidermis of the sides of the ridge and the fiber at its summit.

The cells composing the bands of hypodermal fiber show a more uniform character than those of *J. pilosa*, though the cells at the summit of the ridges generally show larger cavities than cells of the same tissue elsewhere. Its distribution is the same as in the basal section of *J. pilosa*, but the masses of this tissue below the bundles are separated from the bundle by three or four cells that form a continuous ring with the pitted chlorophyll-bearing cells, but are either entirely without contents or have only a few chlorophyll grains. The second ring of chlorophyll-bearing cells is consequently interrupted above the bundle by colorless parenchyma and below it by hypodermal fiber, and so exists simply as a band on each side of the bundle. Besides the cells arranged radially about the bundles, there are others more irregularly lobed that occur near the epidermis where it is contiguous to colorless parenchyma. Median sections do not differ much from basal sections. The ridges are more acute, and two or three secondary bundles intervene between two primary ones. The fibrous cells are a little smaller and have thicker walls, and the cells of the sheaths of the large bundles are more nearly of a uniform size and thickness. Hypodermal fiber does not (as in *J. pilosa*) occur under the colorless parenchyma between ridges.

DISTICHLIS SPICATA.

When dry, the leaves of *D. spicata* are involute throughout. The epidermis of the leaf shows irregularities like those of *Eragrostis obtusiflora*, but more numerous and larger, and in addition covering the fibrous tissue of the lower face. The chlorophyll-bearing parenchyma is not different from that of the other grasses. The bundle sheaths and secondary bundles resemble those of *Eragrostis obtusiflora*, but the primary bundles have the phloëm interspersed with thick-walled cells like those that separate it from the xylem; these may be in an irregular group or may form an interrupted line dividing the phloëm into two parts. Colorless parenchyma is absent except in the bands between the bundles. There is none at the summit of the ridges nor within the ring of chlorophyll-bearing cells. The fiber has the same distribution as in *Eragrostis obtusiflora*, but all the cells both above and below the bundles and at the margin are very thick-walled, with the cavity almost obliterated by the inner thickening layer.

In all the species that we have described it will be observed that the general arrangement of the tissues is the same—that is, the chlorophyll-bearing tissues are arranged in two rings concentric with each fibrovascular bundle, and each concentric system is separated from the next by a band of colorless parenchyma. All but *J. straminea* are deeply furrowed on the upper face, and all, either on one or on both faces, are well furnished with exodermal expansions. The furrowed leaves are either permanently closed as in *J. pilosa* and ♂ *J. straminea*, or have the power of rolling or unrolling in accordance with varying degrees of moisture. The ♀ *J. straminea* alone lacks this power, and thus shows itself less fitted for extremes of drought and heat than do the others. Bands of large thin-walled, colorless parenchyma cells are very common in grasses of dry regions. It is thought that such cells supplement those of the epidermis as storage places for water. It has also been suggested that when situated under bulliform cells they aid these to perform their function. In some cases, however, this is clearly not the actual effect; for, as in the example before us, *J. straminea*, such cells may be present in unusual size and abundance and still the leaf may prove singularly immovable. It is possible that such an arrangement aids in admitting light to the interior of the leaf, and this view is supported by the fact that the lobes of the chlorophyll cells are perpendicular to the band, just as palisade cells are perpendicular to the surface of many leaves. The advantage of additional means for utilizing light is evident when we consider that the extent of leaf surface exposed to the air is frequently reduced to a minimum in order to prevent excessive evaporation.

A strong development of fibrous tissue and strong bundle sheaths are common to grasses of dry regions, but it is rare that isolated strands of such tissue appear below the bands of colorless cells as in *J. pilosa*; they are usually found opposite the bundles only or form a continuous layer along the whole under surface of the leaf. It is also of rare occurrence to find so marked a difference between basal and median sections of the same leaf. The hypodermal fiber of *J. pilosa*, as we have seen, presents much variety both in quantity and in character. Its cells range from those with scarcely thickened walls to those whose cavity is almost entirely obliterated, and range from a group of a few cells only to very large, strong masses. A comparison of leaves of very rigid plants of *D. spicata* with the least rigid specimens of the same species shows that in this grass also the same thing is true of fibrous tissue. Its presence in certain positions is practically constant, but the size of the strands and the thickness of the walls of the individual cells vary much.

Although the leaves of the grasses under consideration differ from each other sufficiently to render it unlikely that necessity should arise for distinguishing them by anatomical characters, yet it is interesting to note that in case of such a contingency separation of the species by structural peculiarities would be an easy matter. It would be of importance that the leaf to be examined should be fully developed, and if only a portion of a leaf were at hand to know whether it were basal, median, or apical. The latter question is not of vital importance, however, though where there is a choice in the matter a median section is best. The staminate plants of *J. pilosa* and *J. straminea* could not be separated by anatomical characters, but assuming as the standard a median section of a full-grown leaf of a ♀ plant of each species, the following table would serve to separate these four grasses:

Leaves unfurrowed on the upper face.......................... ♀ *Jourea straminea.*
Leaves furrowed on the upper face.
  1. Colorless parenchyma below the hypodermal fiber at the summit of the ridges, *Eragrostis obtusiflora.*
  2. No colorless parenchyma at the summit of the ridges.
    a. Leaf thick; inferior epidermis smooth or nearly so; fiber situated under the colorless parenchyma between the bundles.................*Jourea pilosa.*
    b. Leaf thin; inferior epidermis rough with numerous expansions; no strand of fiber under the colorless parenchyma between the bundles, *Distichlis spicata.*

EXPLANATION OF PLATES.

Plate I. Poa turneri Scribn. *a*, empty glumes of ♀ spikelet; *b*, four florets of the same; *c*, empty glumes of ♂ spikelet; *d*, florets of the same.

Plate II. Poa leibergii Scribn. *a*, empty glumes; *b*, spikelet with the empty glumes removed; the lower figure on the left represents the flowering glume expanded.

Plate III. Panicum leibergii Scribn. *a*, spikelet showing first glume; *b*, spikelet seen from the opposite side, showing the second glume; *c*, spikelet seen from the side, showing portions of four glumes; *d*, third glume with its palea; *e*, fourth glume seen from the back; *f*, fourth glume and palea.

Plate IV. Elymus brownii Scribn. & Smith. *a*, portion of the rachis of the spike, showing two pairs of empty glumes; *b*, spikelet, empty glumes removed.

Plate V. Eragrostis obtusiflora Scribn. *a*, empty glumes of the spikelet; *b*, spikelet, the lower empty glumes removed; *c*, flowering glume expanded; *d*, lateral view of palea; *e*, portion of the rootstock.

Plate VI. Sporobolus plumbeus Hemsl. *a*, spikelet; *b*, empty glumes; *c*, flowering glume and palea; *d*, caryopsis.

Plate VII. Muhlenbergia flaviseta Scribn. *a*, empty glumes; *b*, flowering glume and palea, a portion of the awn removed; *c*, second empty glume, expanded.

Plate VIII. Leaf structure of *Jouvea* and of *Eragrostis obtusiflora*.

Fig. 1. Portion of a basal section of the leaf of *Jouvea pilosa; a, b*, epidermal cells.

Fig. 2. Portion of a median section of the leaf of *Jouvea pilosa; a*, exodermal expansion of an epidermal cell.

Fig. 3. Diagram of median section of the leaf of *Eragrostis obtusiflora*, showing conduplicate form.

Fig. 4. Diagram of a transverse section of the leaf of *Eragrostis obtusiflora*, showing involute form.

Fig. 5. Apical section of the leaf of *Jouvea pilosa*.

Plate IX. Leaf structure of *Jouvea*, *Eragrostis obtusiflora*, and *Distichlis spicata*.

Fig. 6. Portion of a median section of a leaf of *Jouvea straminea; b*, lateral bulliform cells.

Fig. 7. Portion of a section of a leaf of *Eragrostis obtusiflora*.

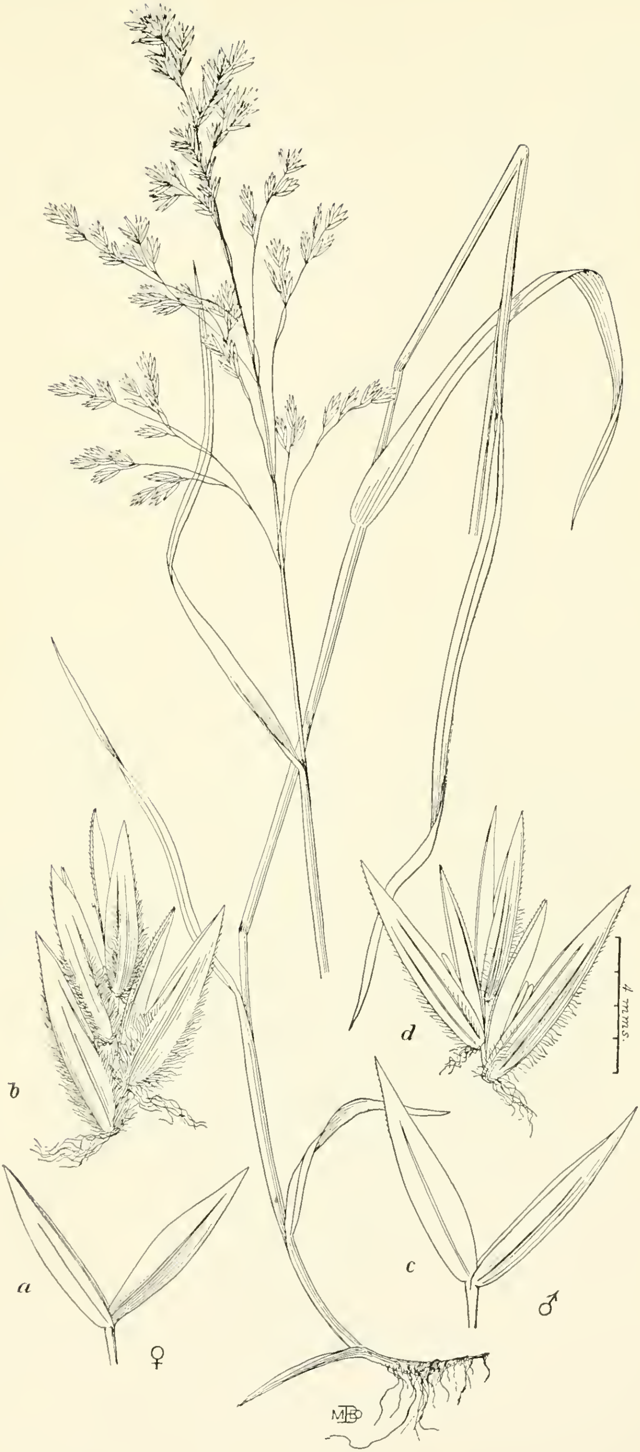
Fig. 8. Portion of a section of a leaf of *Distichlis spicata*.

Fig. 9. Portion of a section of a leaf of *Distichlis spicata*, bleached, showing radial arrangement of cells.

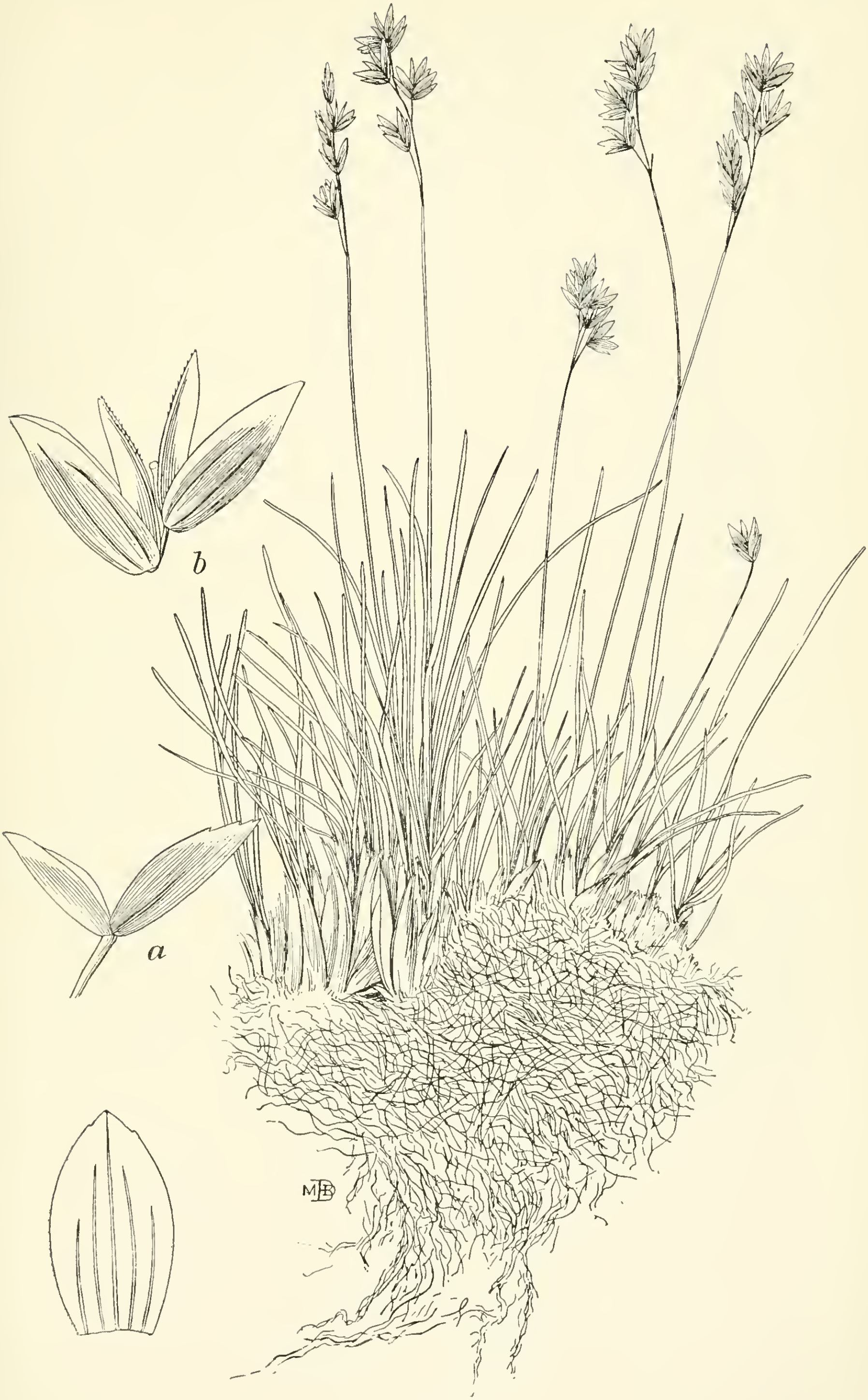
Fig. 10. *a*, portion of longitudinal section of a leaf of *Jouvea pilosa*; *b*, isolated, lobed, assimilating cells.

In figures 1 to 9 inclusive of Plates VIII and IX the lettering is as follows:

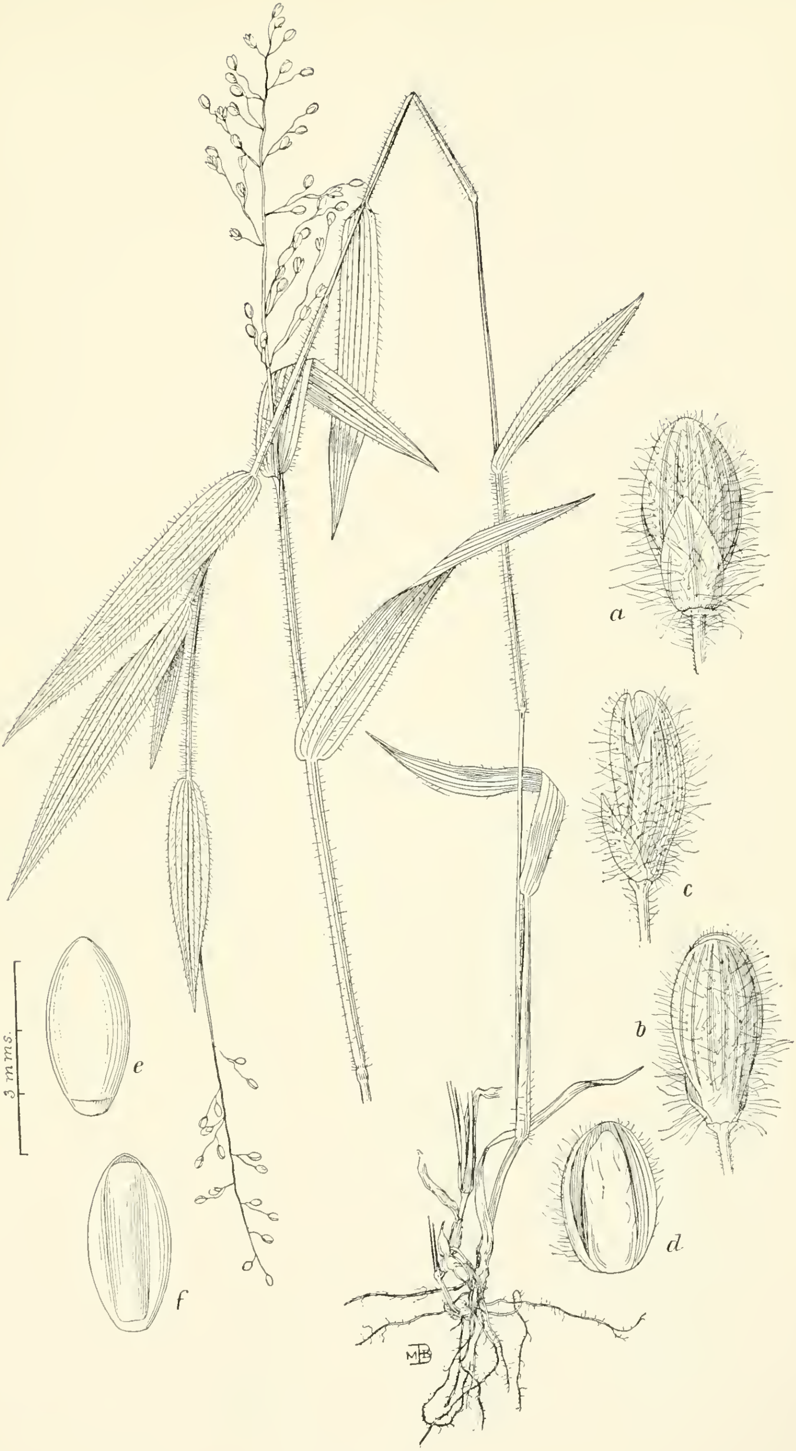
Transverse sections: M, midnerve; *inf ep*, inferior epidermis; *sup ep*, superior epidermis; B, group of bulliform cells; *ch*, pitted chlorophyll-bearing cells; *l*, lobed chlorophyll-bearing cells; *cp*, colorless parenchyma; *x*, xylem; *ph*, phloëm; *s*, sheath of fibro-vascular bundle; *st*, stoma.


b
d
4 mms.
a
♀
c
♂
MB

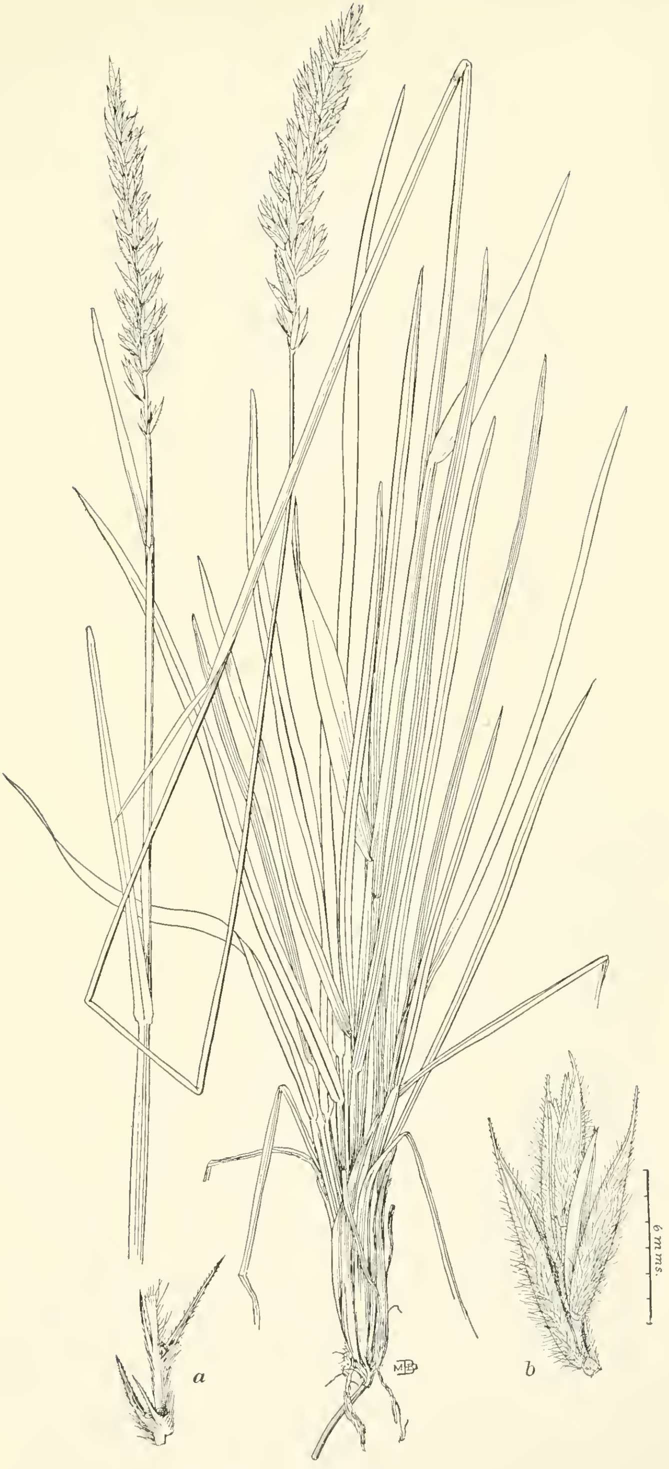
POA TURNERI Scribn.



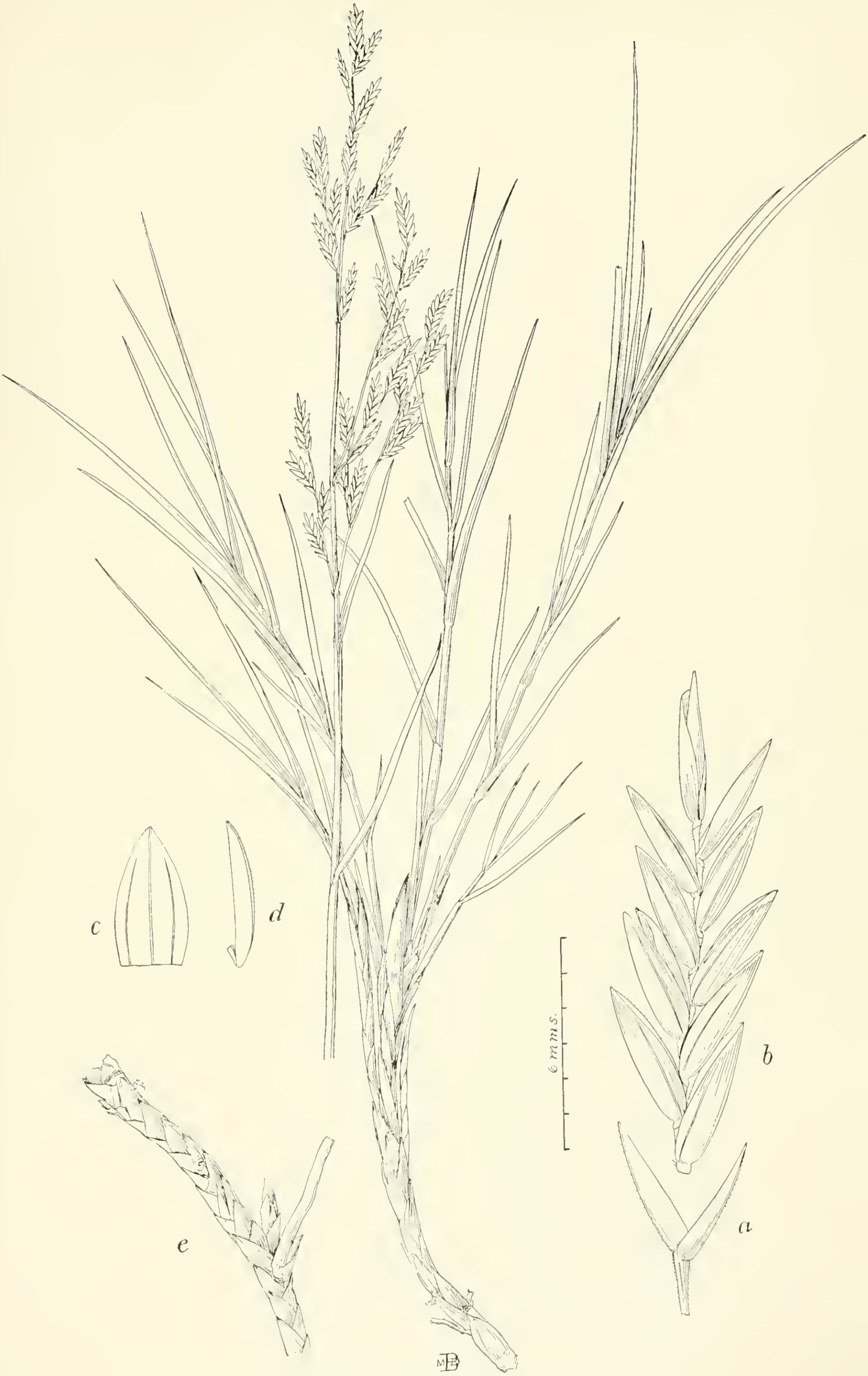
POA LEIBERGII Scribn.


a
c
b
d
e
f
3 mms.
MB

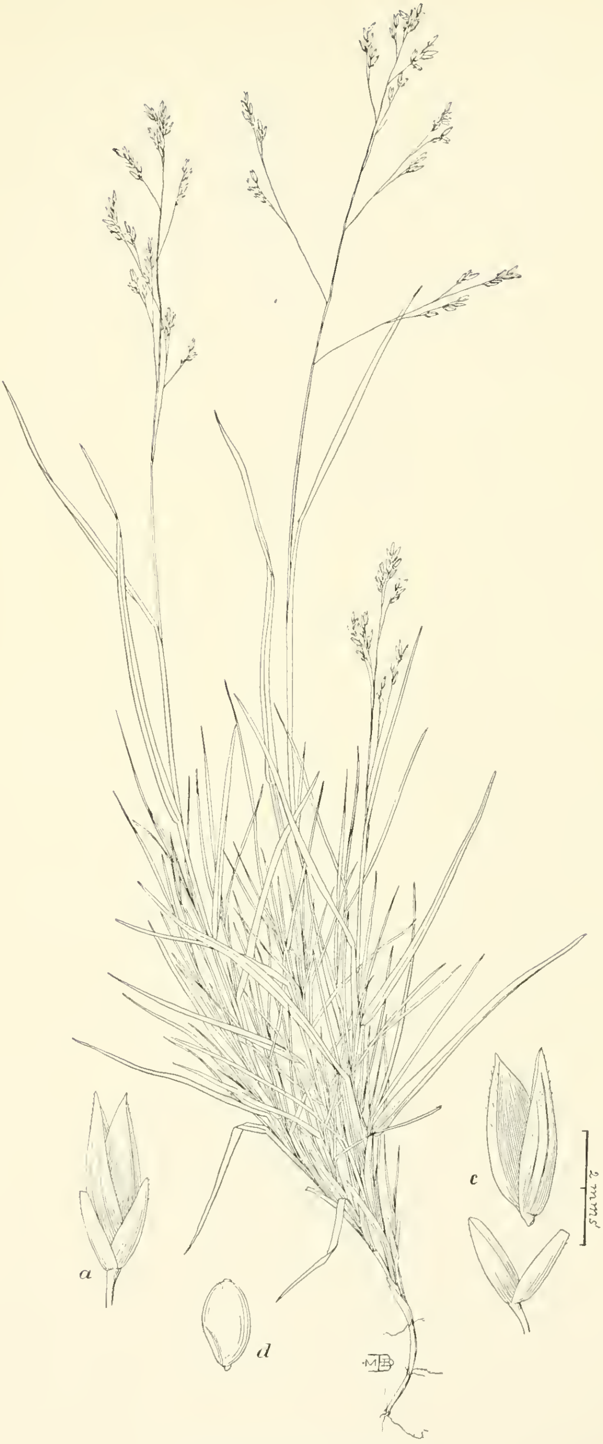
PANICUM LEIBERGII Scribn.



ELYMUS BROWNII Scribn. & Smith.

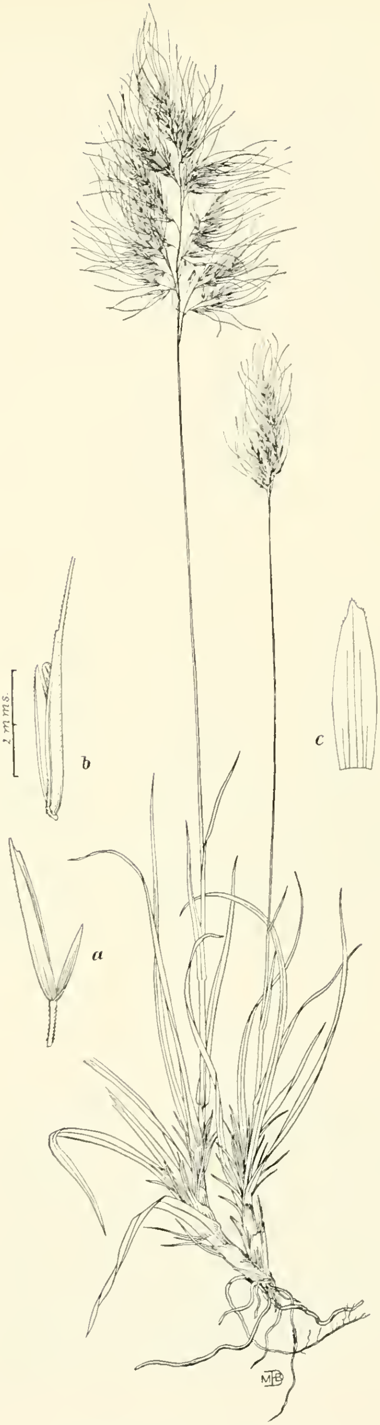

c
d
b
a
e
6 mms.
MB

ERAGROSTIS OBTUSIFLORA Scribn.

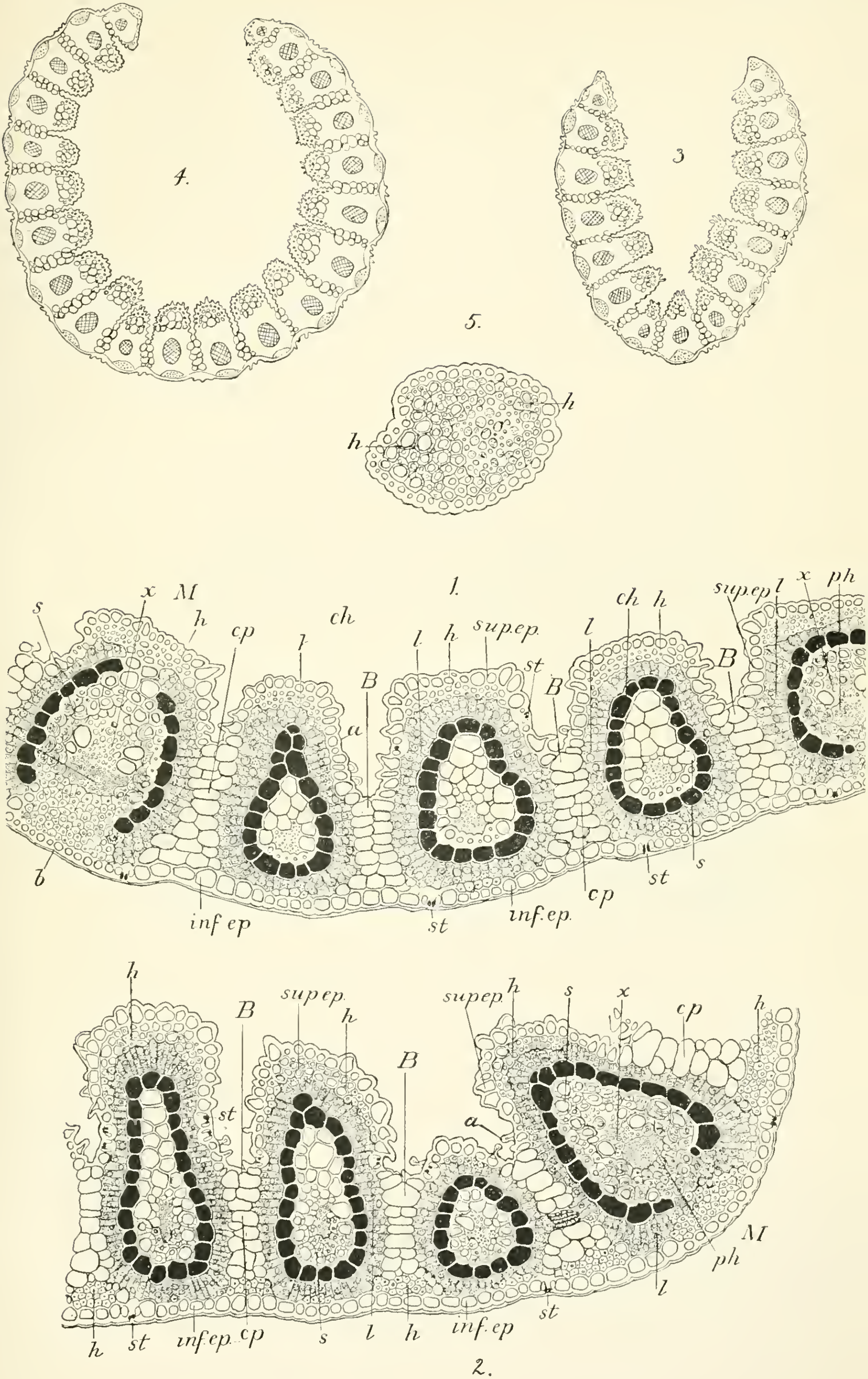


SPOROBOLUS PLUMBEUS Hemsl.

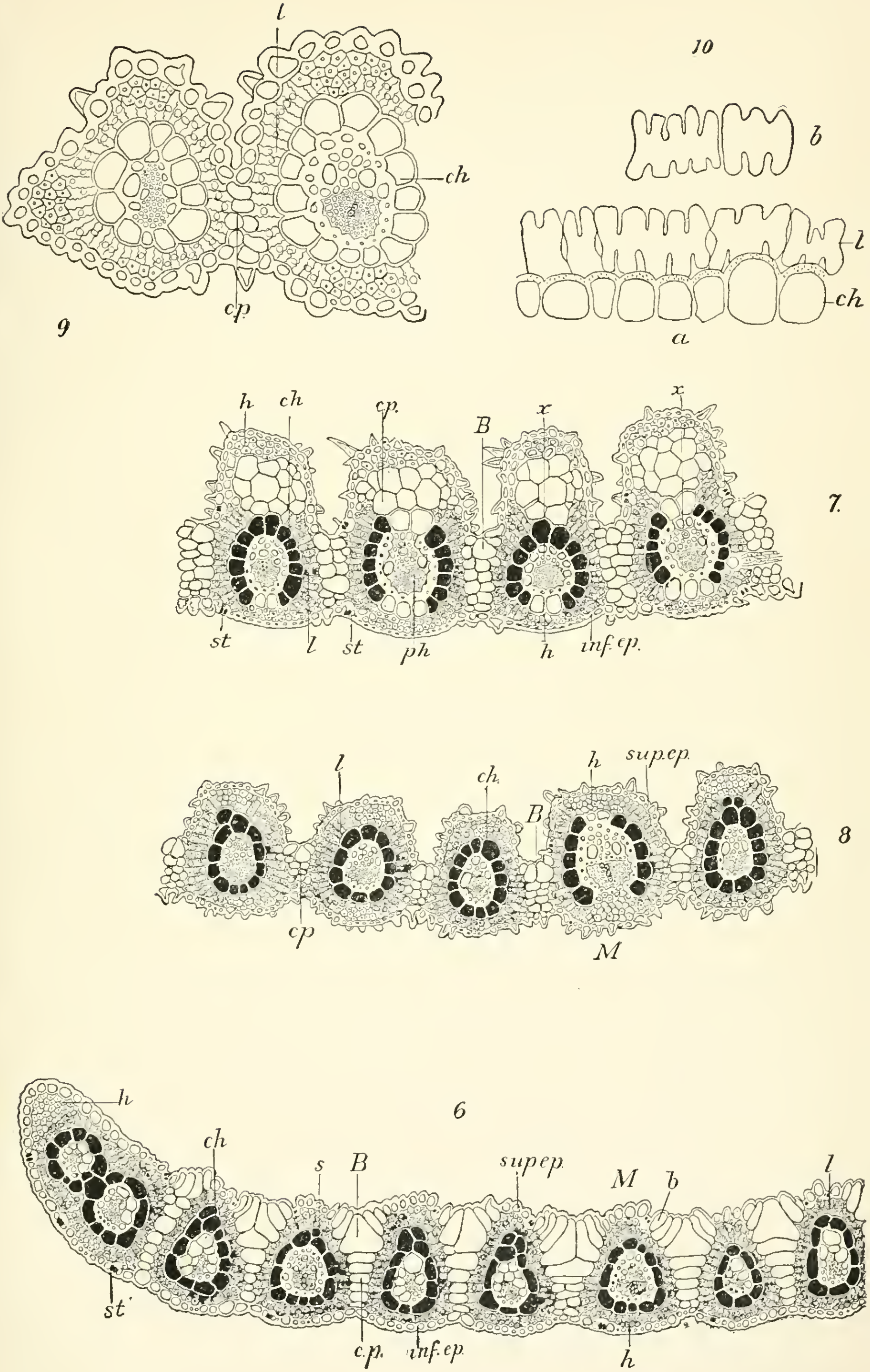
PLATE VII.



MUHLENBERGIA FLAVISETA Scribn.


4.
3
5.
h
h
1.
s
x
M
h
cp
ch
l
B
a
l
h
sup.ep.
st
B
l
ch
h
sup.ep
l
B
x
ph
s
b
inf ep
st
inf.ep.
cp
st
2.
h
B
sup.ep.
h
B
sup.ep.
h
s
x
cp
h
st
a
M
ph
l
h
st
inf.ep.
cp
s
l
h
inf.ep
st

LEAF STRUCTURE OF JOUVEA AND ERAGROSTIS OBTUSIFLORA.


l
ch
cp
9
10
b
l
ch
a
h
ch
cp.
B
x
x
7
st
l
st
ph
h
inf. ep.
l
ch
h
sup.ep.
B
8
cp
M
h
6
ch
s
B
sup.ep.
M
b
l
st
c.p.
inf. ep.
h

LEAF STRUCTURE OF JOUVEA, ERAGROSTIS OBTUSIFLORA, AND DISTICHLIS SPICATA.

INDEX.

Page.

- Brizopyrum obtusiflorum 5
- Distichlis spicata 10, 12, 18
- Elymus angustus 9
  - arenarius 8
  - brownii 7, 8
  - dasystachys 8
    - asper 9
    - littoralis 8
  - flavescens 8, 9
  - junceus 8
  - littoralis 8
  - mollis 7, 8
- Eragrostis obtusiflora 5, 10, 12, 17
- Jouvea pilosa 5, 12
  - straminea 5, 12
- Muhlenbergia flaviseta 11

Page.

- Muhlenbergia gracilis 11
- Panicum leibergii 6, 7
  - pauciflorum 7
  - scoparium 7
    - leibergii 6
  - scribnerianum 7
    - leibergii 6
- Poa hispidula 6
  - leibergii 6
  - lettermani 6
  - pattersoni 6
  - pringlei 6
  - turneri 5
- Sporobolus plumbeus 10
- Vilfa plumbea 10

BOTANICAL GARDEN

BULLETIN No. 9. Agros. 20.

U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF AGROSTOLOGY.
[Grass and Forage Plant Investigations.]

NOTES
ON THE
GRASSES AND FORAGE PLANTS
OF
IOWA, NEBRASKA, AND COLORADO.

BY

L. H. PAMMEL,
Professor of Botany in Iowa Agricultural College.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.

1862 1889

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.

BULLETIN NO. 9. Agros. 20.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

NOTES

ON THE

GRASSES AND FORAGE PLANTS

OF

IOWA, NEBRASKA, AND COLORADO.

BY

L. H. PAMMEL,

Professor of Botany in Iowa Agricultural College.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., August 10, 1897.

SIR: I have the honor to transmit herewith and recommend for publication as Bulletin No. 9 of this Division, a report by L. H. Pammel, professor of botany in the Iowa Agricultural College, on the grasses and forage plants of Iowa, Nebraska, and Colorado. The three States included in this report, especially the first named, are great stock-raising States, and all information pertaining to the food supply—the grasses and forage plants—for the cattle, horses, and sheep can not fail to be of interest. This report is in line with the investigations of the grasses and forage plants of the Northwest now being carried on by the Division.

The report here presented is divided into three parts, the first including general observations upon the physical conditions and important questions relative to forage production in the States named; the second is devoted to an enumeration of the more important grasses and forage plants of these States, alphabetically arranged, with economic notes; in the third part the author presents a classified list of the grasses of Iowa, Nebraska, and Colorado collected by him during the seasons of 1895 and 1896.

Respectfully,
F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.
Field notes and general observations 7
  Introduction 7
  Iowa 7
    General features of central and western Iowa 7
    Obstacles in the way of growing native forage plants 9
  Nebraska 10
    The forage problem 10
    Native grasses 10
  Colorado 11
    Central and northern Colorado 11
    Forage conditions of the prairies and sand hills 12
    Grasses and forage plants of the foothills and mountains 13
    Chemical composition of some Colorado forage plants 15
List of the more important grasses and forage plants of Iowa, Nebraska, and Colorado, with economic notes 16
List of grasses collected in Iowa, Nebraska, and Colorado 35

ILLUSTRATIONS.

Page.
FIG. 1. Alfalfa (*Medicago sativa*) 16
2. Big Blue-Stem (*Andropogon provincialis*) 18
3. Blue Grama (*Bouteloua oligostachya*) 19
4. Buffalo-grass (*Bulbilis dactyloides*) 21
5. Fresh-water Cord-grass (*Spartina cynosuroides*) 22
6. Hungarian Brome-grass (*Bromus inermis*) 24
7. Kentucky Blue-grass (*Poa pratensis*) 25
8. Orchard-grass (*Dactylis glomerata*) 28
9. Prairie June-grass (*Koeleria cristata*) 29
10. Short-awned Brome (*Bromus breviaristatus*) 31
11. Side Oats Grama (*Bouteloua curtipendula*) 32
12. Turkey-foot-grass (*Andropogon hallii*) 34

NOTES ON THE GRASSES AND FORAGE PLANTS OF IOWA, NEBRASKA, AND COLORADO.

FIELD NOTES AND GENERAL OBSERVATIONS.

INTRODUCTION.

One of the most important industries in the States of Iowa, Nebraska, and Colorado is that of stock raising, and consequently the forage and the conditions of the native forage plants are subjects of vital interest to the farmer. In order to study these conditions several of the more important points in Iowa west and northwest of Ames were visited at various times in 1895 and 1896, and in the latter year collections and observations were made in the vicinity of Omaha, Lincoln, Crete, Hastings, and McCook, in Nebraska, and also in northern and central Colorado in the vicinity of Fort Morgan, Greeley, Fort Collins, Golden, Denver, and Colorado Springs. Some time was spent in the foothills and mountains west of Fort Collins along the tributaries of the Cache la Poudre, at Clear Creek Canyon west of Golden, at Cheyenne Canyon not far from Colorado Springs, and on Pikes Peak.

IOWA.

GENERAL FEATURES OF CENTRAL AND WESTERN IOWA.

West of Ames there are several important valleys—the Des Moines, Coon, and Boyer; northwest of Carroll there are the Little and Big Sioux, the Maple, and the Floyd. Along the Coon and Des Moines rivers the country is rough, and but little hay is cut, though much of the timber land is used for pasture. Along the Boyer, Maple, and Floyd rivers the immediate banks contain some timber, but the flood plains are open and covered with a luxuriant growth of grasses.

The forage question in central Iowa is very different now from what it was fifteen years ago. At that time considerable areas of unbroken sod still remained. Now the wild prairies have almost ceased to be a factor in the production of hay. The extensive prairies have given way to cultivated fields and pastures. Small unbroken areas occur here and there, but these are chiefly confined to the small drainage basins between hills, and exist largely because in times of considerable precipitation these depressions are too moist for proper cultivation. The Boyer and Maple valleys are noted for the large crops of wild hay annually produced. The same may be said of the rich alluvial flood plain of the Missouri. This plain varies from a few to 15 miles in width, the average being from 8 to 12. The hay crop constitutes one of the chief sources of revenue for the farmers of this region, and could be made much more important if they would follow a more rational system of cropping.

The chief hay plants cultivated in central Iowa are Timothy, Redtop, Blue-grass, and Red Clover. The principal plants used in pastures are Blue-grass, White Clover, Redtop, and Timothy. In the Boyer and Maple valleys and on the Missouri bottoms the wild grasses predominate. To a limited extent, alfalfa meadows have been started in Carroll, Ida, and Woodbury counties. The loess hills, skirting the Missouri bottoms, are mostly cultivated, though unbroken wild meadows and pastures still remain. In the eastern portion of this district considerable corn fodder is used as forage, the amount used depending largely upon the condition of the pastures and meadows.

Many other grasses have been tried with varying success. Orchard grass, naturalized in many places, is one of the most successful. Tall Oat-grass gives some promise. Perennial Rye-grass is nearly worthless for this section of the State. Italian Rye-grass is unable to resist the cold of our winters and is a complete failure. Meadow Foxtail (*Alopecurus pratensis*) does fairly well as an early grass when sown the season before, but is hardly adapted to this section. The most promising of the recently introduced grasses is Smooth or Hungarian Brome. The Short-Awned Brome has also been tried and is very promising. Rye and Barley are often used as forage plants. German millet and Hungarian-grass find extended use some seasons. Broom Corn Millet is frequently sown in northern and northwestern Iowa.

But one legume is generally grown, and that is Red Clover. Mammoth, or Medium, Clover is often sown, but is much less common than the preceding. Alsike Clover is becoming more common. Two sweet clovers are not infrequent; the White Sweet Clover is more abundant than the yellow. Crimson Clover has been tried repeatedly, but is not adapted to Iowa conditions. It suffers much from drought in late summer, and from insect and fungus enemies.

Many native species of grasses occur, and they vary in quantity and quality in different sections of the State. The dominant grasses of central Iowa are Little Blue-Stem and Big Blue-Stem. Both of these species are frequently called Blue-Joints. Several species of Elymus are abundant, as Wild Rye, on the prairies and meadows; Lyme-grass on the flood plains of streams, and Dennett-grass along the borders of woods. Other common grasses are: Indian Beard-grass, or Bushy Blue-Stem, in prairies and open woods; Tall Grama-grass of the dry prairies and gravelly knolls; Nodding Fescue in woods; Slender Fescue in dry sterile soils; Short's Fescue in low prairies, a most valuable species; Switch-grass in rather moist meadows; Satin-grasses (*Muhlenbergia racemosa*, *M. diffusa*, *M. willdenovii*, and *M. mexicana*) in moist soil of open woodlands and meadows; Swamp Chess in open woodlands; Fowl Meadow-grass in low grounds along streams; Wire-grass and Squirrel-tail-grass, an introduced species, in meadows and waste places; Blue-Joint, Reed Canary-grass, Common Reed-grass, and Floating Manna-grass in marshy places and shallow water; Large Rush-grass and Bunch-grass in dry prairies. In northwestern and western Iowa the above as well as some additional species occur. Among the latter are Western Wheat-grass, Bearded Wheat-grass, Blue Grama, Slough-grass, and Big Sand-grass.

The most widely-distributed of all the native leguminous plants is Canadian Rattle-weed (*Astragalus canadensis*), a thrifty, hardy, and vigorous species found in woods, low meadows, and prairies. It is eaten by stock, but becomes rather woody when old. Buffalo Pea, or Ground Plum, is common on dry sterile hills throughout the region and affords valuable forage. American vetch is one of the most valuable of the native legumes. It grows in the moist soil of low prairies and open woodlands. This vetch is well adapted to the conditions of western and northwestern Iowa, and does well under cultivation. The prairie clovers (*Petalostemon violaceus* Michx., and *P. candidus* Michx.) are common on the prairies everywhere, as also on the loess soils of western Iowa. These plants are seldom eaten by stock unless forage is scant. *Dalea alopecuroides* Willd. is common throughout the loess region and has been introduced farther eastward. Wild vetch, well known as a valuable forage plant of the Northwest, is indigenous to the loess, though not abundant except locally. It has been introduced into Boone County. Running Buffalo clover (*Trifolium stoloniferum* Muhl.), a native, is considered a valuable forage plant by the farmers of western Iowa, and is worthy of a trial under cultivation. Mention should also be made of a Loco plant (*Oxytropis lambertii* Pursh.) native to this region. Though often consumed by stock, no complaints have been made that it produces loco poisoning. Rattlebox (*Crotalaria sagittalis* L.) occurs in the more sandy bottoms of the Missouri River. Complaints have frequently been made of the trouble it causes when fed to horses. The disease it produces has been called "crotalism."

OBSTACLES IN THE WAY OF GROWING NATIVE FORAGE PLANTS.

There are some serious obstacles in the way of maintaining the native meadows and pastures of Iowa. These may be classed under two heads—the overstocking of pastures and the growth of weeds. Many farmers attempt to raise more stock than their pastures will safely accommodate. The grasses can not endure the close grazing and excessive trampling to which they are subjected, and consequently they die out. Snow in this section of the State is usually blown from the open fields soon after falling, and hence can not be depended upon to protect the grass roots in pastures that have been too closely grazed. As a result of this, weedy annuals, like Southern Poverty-grass, Foxtail and Squirreltail spring up to take the place of the better perennial species, or the native ragweeds and verbenas spread and occupy the soil. All of these have become so plentiful that farmers remark on their more frequent occurrence now than in former years. Several rank-growing weeds are abundant in meadows and pastures of western Iowa. Sunflower and Marsh Elder find in the rich alluvial soil of the river bottoms a most congenial place for their development. They are especially troublesome on land that is often flooded during spring freshets. It may be that farmers of this region who rely chiefly on the hay crop will be obliged to introduce better turf-forming grasses, such as can resist the inroads of these weeds. From what I have seen of Blue-grass in this region it may prove a good grass for this purpose and Hungarian Brome (*Bromus inermis*) may prove to be of even greater value. Snow-on-the-Mountain (*Euphorbia marginata*), a well-known ornamental plant, is a serious pest in western and northwestern Iowa. Golden Rods are often troublesome in pastures, especially *Solidago canadensis* and *S. rigida*. Stock will not eat them unless forced to do so, and when once well established in the pasture they are very difficult to eradicate.

NEBRASKA.

THE FORAGE PROBLEM.

The forage problem of Nebraska is one of peculiar interest. A great variety of native species occur because of the diversified climate and soils of the State. Observations were made in the vicinity of Omaha and thence southwest to Lincoln, Crete, Hastings, and McCook to the Colorado line. The rich, fertile bottoms along the Missouri, the rolling prairie west of Omaha, the fertile valleys of the Platte, Salt, and Blue rivers, the salt marshes in the vicinity of Lincoln, the vast stretch of level prairie about Hastings, the flood plain of the Republican River, with the rolling clay hills that rise from this valley, the narrow canyons, and the sand hills in the western part of the State are striking illustrations of the varied features of this region. Grazing is now, and ever will be, an important industry in the western half of the State. Although the grasses may not grow so luxuriantly season after season in Nebraska as in Iowa, the climate is more favorable for winter grazing than in the latter State, and there is a large number of valuable species of native forage plants.

NATIVE GRASSES.

It will not be necessary to discuss the forage plants of eastern Nebraska, as the conditions are similar to those in Western Iowa, and the foregoing remarks will apply to this region.

In the central and western parts of the State the farmer relies chiefly on the native forage plants. I was unable to find a single introduced grass superior to Grama-grass, Wild Wheat, Turkey-foot, Big Blue-Stem, and Buffalo-grass. I was strongly impressed with the fact that the grasses best adapted to this climate are the native species. In alluding to the value of our native grasses to obtain improved forms, Prof. F. Lamson-Scribner says:

> Nearly all of our cultivated forage plants are of foreign origin, and if it were not simply a matter of public interest, it ought to be one of public sentiment to preserve for the coming generations of American farmers these native species which have added so much to the wealth of the land in the past. The species in the grazing regions in the west and southwest, and for that matter, in every part of this country where sheep or cattle are raised, are best adapted for the conditions under which each grass grows, and it is folly to think that better forms may be introduced from Europe or Asia or Australia, where climate and soil and abundance of rainfall are different. The meadow grasses of the parks, woodlands, and mountain slopes, the Grama and Buffalo grasses of the southwest and the Blue-stems of the eastern prairie belt, can not be improved upon.
>
> It certainly seems to me that the time has arrived for us to consider the advisability of saving from extermination the numerous valuable forage plants found in the arid and subarid portions of our country. The long-continued existence of these grasses shows that they are adapted to the climate in which they occur. For ages these valuable grasses have defied unfavorable climatic conditions and have stood the tramping and grazing of vast herds of buffaloes.

Central Nebraska is very favorably situated for grazing. The soil in this section is productive, as is evidenced by the fine crops of corn and small grain which have been grown here under favorable climatic conditions. Influenced by these fine crops, settlers occupied the country and the valuable native turf was turned under and the land devoted to the growth of small cereals and corn. The results in many instances have been anything but satisfactory. No method of agriculture or human agency can control weather. The ordinary cultivated crops can not be produced with a scant rainfall. The semiarid belt is superb as a grazing country, unexcelled west of the Missouri. A crop of grass is just as certain here as corn is in eastern Nebraska. The climate is favorable for winter grazing and stock will need little attention. The crop can not be as large as under conditions of greater moisture, and the grazing lands must be kept under certain restrictions. Business men and intelligent farmers with whom I have conversed believe that the only salvation for this region is the stock industry. It will take some years to again see the turf-forming grasses cover the field where the plow has destroyed the sod which was many seasons in forming. Some believe that they will never return. It requires time to reestablish a prairie, just as it does a forest, when once burned over, to become covered with trees again. Annuals appear first, some nearly worthless, but these prepare the way for the better perennials, like Blue-Stem and Grama.

COLORADO.

CENTRAL AND NORTHERN COLORADO.

The conditions prevailing in central and northern Colorado are so different that the subject can not well be discussed under one head. In northeastern Colorado the conditions are much the same as in western Nebraska. In the semiarid regions considerable areas were at one time cultivated, but, after a few years of unsuccessful attempts at raising corn, oats, and wheat, the land has been allowed to revert to grass. The several branches of the Republican River rise in the sand-hill region of eastern Colorado. This section of the State has become famous as a stock country and is seemingly prosperous. Nearly every farmer is provided with a neat house. Windmills are numerous for the purpose of providing water for the stock. The country to the north, drained by the Platte, is likewise largely devoted to the cattle industry. The most conspicuous grasses are considered in detail elsewhere in this paper. Though the rainfall is limited, there are thousands of acres of fine meadows and grazing lands covered with a dense growth of Grama-grass. In some places this grass would yield a ton of hay to the acre.

FORAGE CONDITIONS OF THE PRAIRIES AND SAND HILLS.

Turkey-foot-grass, or Big Blue-Stem, 4 to 5 feet high, grows very luxuriantly over the sand hills. Western Wheat-grass, from 2 to 3 feet high, grows on the open prairies where not pastured. The year 1896 was certainly most favorable for the growth of these wild grasses. Such a season demonstrates what this region can do in the way of grass production. In Washington County, in the vicinity of Akron, with a higher altitude than at Robb, Wray, and Yuma, the ranges were in excellent condition, though not as good as in the sand-hill region. In the vicinity of Fort Morgan the range conditions were not so good; there was less rainfall and the grasses were closely cropped. Still the region afforded some good grazing, consisting chiefly of Blue-Stem, Indian Millet, Western Wheat-grass, Blue-Grama, Buffalo-grass, Wild Rye, Feather Bunch-grass, and Needle-grass.

In the country surrounding Fort Morgan the ranges are chiefly used for sheep raising. Along the Platte to the east and west are several large irrigation ditches. The chief forage plant grown here is alfalfa. Too much praise can not be given to this plant. There are thousands of acres of it. Three crops are cut in a season, and the hay brings from $3.50 to $4 a ton. In many cases the farmers allow their sheep to run on the range in the summer and in the winter feed them on alfalfa hay.

Greeley and Fort Collins in northern Colorado are famous for the large areas under irrigation. Some of the most valuable irrigated lands of the State are located here. The principal streams supplying water for irrigation are the Platte, Cache la Poudre, Big Thompson, Clear Creek, and Boulder Creek. Here, as elsewhere east of the mountains, alfalfa is one of the chief crops. At several points dairying is an important industry, and the fattening of sheep and cattle on alfalfa is assuming considerable importance. The fact that alfalfa is a bulky crop makes it more profitable to ship cattle to points where this crop is grown than to ship the fodder great distances. It would seem, however, that Colorado can not at present produce enough alfalfa to supply her own demands. A great deal of range stock is shipped out to be fattened in Iowa, Nebraska, and other States.

Three Brome grasses are becoming established in the vicinity of the Colorado Agricultural College. Two of these, Hungarian Brome (*Bromus inermis* L.) and Rescue-grass (*Bromus unioloides* Willd.), are valuable forage plants. The third (*Bromus tectorum*) is a weedy annual on the grounds of the experiment station. Many of the cultivated species such as Timothy, Redtop, Blue-grass, and Orchard-grass, are naturalized in many places, but farmers, as a rule, do not make a business of growing these grasses, as they do not thrive without irrigation. Alfalfa occasionally grows where the soil has not been irrigated for a season, but the growth is so poor that it is often not worth the cutting. Several other leguminous plants are common. White Sweet Clover is a weed in many of the irrigated districts. Yellow Sweet Clover is less common than the White. Neither of these, so far as could be learned, is used for forage.

A large number of native grasses occur along irrigating ditches and streams, and many of them are highy nutritious. One of the most conspicuous is Slender Wheat-grass, which grows to a height of 3 to 4 feet and produces a large number of leaves. The Western Wheat-grass is also much more productive in such situations than in high and dry soil. Feather Bunch-grass grows luxuriantly. Wild Rye is a large and coarse grass of little value when compared with many of the other species noted here. In low, swampy places Slough-grass grows from 1 to 4 feet high, and makes fine hay. *Polypogon monspeliensis* Desf., a weedy annual, also occurs along irrigating ditches. *Catabrosa aquatica* is an aquatic grass of irrigating ditches and wet canyons in the foothills. These have been disseminated on the plains by water brought from the mountains. Macoun's Rye-grass (*Elymus macounii* Vasey) occurs in the flats along the river courses. Cord-grass occurs in low ground and Slender Cord-grass is sparsely represented in alkaline marshes. Fowl Meadow-grass is abundant in the fields in the vicinity of Fort Collins and Golden. Squirrel-tail-grass is plentiful in seepage meadows and is a noxious weed when the bearded "heads" have formed, though it is of some value when young. The common Reed-grass occurs in quantity in the low meadows, but it is of little agricultural value. The marshes contain numerous sedges and rushes, as *Carex marcida*, *C. ajuncis*, *Scirpus lacustris*, and others. Several species of Juncus are also common.

GRASSES AND FORAGE PLANTS OF THE FOOTHILLS AND MOUNTAINS.

The foothills, as well as the higher mountain slopes, produce a large number of valuable grasses. The grass flora is not equally rich throughout, that of the higher altitudes being more varied and richer as to species and quantity. The low foothills which rise from the prairies have many species in common with the prairies. It is only in the canyons that one meets the larger and less common grasses. The grasses of the dry foothills generally grow in small bunches, but they are surprisingly nutritious. Notwithstanding the dry weather prevailing in the foothills during the month of June, 1896, cattle were in most excellent condition, which indicated that they had been fed on forage of superior quality. The conditions are such as one occasionally finds in the case of Blue-grass during a dry season in the Eastern States, the leaves of the grasses, though perfectly dry, containing an abundance of nutriment. In the narrow canyons and wider valleys a more luxuriant growth was observed, and where stock were not allowed to graze the meadows were in fine condition. The larger valleys up in the mountains are mostly taken up by homesteaders, who select this land since they can here raise a crop of two-rowed barley. This barley is cut and used for hay. The larger wild grasses growing in these meadows are used in a similar way. During the summer the cattle range on the mountains, and in the winter are fed on the hay made in the valleys. Not only do ranchmen grow cattle for beef, but at the lower altitudes dairying is carried on and the butter made finds a ready sale in the mountain towns.

In the lower foothills large areas of pine and Douglass spruce have been to a great extent removed. Several small shrubs, such as Ninebark (*Physocarpus torreyi*), Raspberry (*Rubus deliciosus*), *Purshia tridentata*, and *Jamesia americana*, are common. *Purshia tridentata* is frequently browsed by cattle; in fact many of the plants are picked bare. The chief pine at lower altitudes is *Pinus ponderosus scopulorum*. When not too dense, these woods furnish excellent grazing. At higher altitudes, about 8,500 feet, *Pinus ponderosus* is the principal tree. The woods are usually open enough to allow a growth of grass underneath, and make good ranges, especially since there are numerous small openings, where species adapted to moist soils grow. It has frequently been stated that the burning of these forests is conducive to a good growth of grass. This is true only in mountain meadows. A forest burnt over is absolutely sterile for a term of years, as far as forage plants are concerned. The fire not only destroys whatever turf there is, but it prevents reseeding. Such burnt forests are at first largely covered with various fireweeds, which are of little or no value for forage. In the course of years the character of vegetation changes; grasses and little shrubs appear, then the Trembling Aspen (*Populus tremuloides*) comes up; it soon becomes so thick that but little else will grow, and cattle find little pasturage. A fire, therefore, destroys for a period of years all hope of good forage, and it is to the interest of the ranchman that the forest should not be burnt over. The grasses most suited for these regions are such as are indigenous here; in fact there are few evidences of naturalization. Timothy is not uncommon in the foothills, but was found in only one locality at an altitude of 10,000 feet, along one of the mountain trails. White Clover was also found at nearly the same altitude under similar conditions.

The mountains are marked by extremes of temperature. Early in July, at an altitude of 8,500 feet, it is not uncommon to have the thermometer fall to 40° F. during the night. On the Little Beaver, one of the small mountain streams that finds its way into the south branch of the Cache la Poudre, at an altitude of 9,500 feet, the thermometer registered 38° F. in the morning, and yet at noon, in an open meadow, it was 110° F., most uncomfortably hot. Under such conditions Buffalo Bunch-grass grows to magnificent proportions. Western Bromegrass and Swamp Chess formed large patches. The little Mountain Timothy grows in large masses in the moister woods below. Few of our cultivated grasses can grow under such changeable conditions without losing vitality. At an altitude of 8,500 feet, lower down on Beaver Creek, barley made a poor growth. It was scarcely 6 inches tall, while Buffalo Bunch-grass was not only in flower at 9,500 feet, but seed was forming. How much better to have started a meadow of this bunch-grass than to sow barley every spring.

Three indigenous clovers (*Trifolium nanum*, *T. parryii*, and *T. dasyphyllum*) occur in northern Colorado. The first is a dwarf species of Pikes Peak at and above timber line. The two larger species cover the ground in perfect mats, and are valuable forage plants. Our horses fed on these clovers in preference to the grasses and sedges growing in the vicinity.

CHEMICAL COMPOSITION OF SOME COLORADO FORAGE PLANTS.

The chemical composition of a few Colorado grasses from chemical analyses made at the Colorado Agricultural Experiment Station is as follows:

Analyses of some Colorado grasses.

Grasses.	Water.	Ash.	Fat.	Albuminoid nitrogen.	Crude fiber.	Nitrogen-free extract.
Grama grass (*Bouteloua oligostachya*)	7.33	7.31	1.73	7.51	14.62	68.33
Buffalo grass (*Bulbilis dactyloides*)	7.80	10.33	2.25	7.54	14.59	65.29
Western Wheat grass (*Agropyron spicatum*)	7.91	7.09	2.57	7.32	19.65	63.37
Slender Wheat-grass (*Agropyron tenerum*)	7.86	6.28	2.04	6.15	20.20	65.33
Prairie June grass (*Koeleria cristata*)	8.15	7.96	3.93	6.85	22.58	58.68
Mountain Timothy (*Phleum alpinum*)	7.87	6.30	2.60	10.67	16.91	63.52
Slough-grass (*Beckmannia erucæformis*)	8.36	6.21	3.05	8.53	22.65	59.56
Lupine (*Lupinus plattensis*)	9.87	9.17	1.98	13.68	17.93	57.24
Alfalfa (*Medicago sativa*)	10.92	17.27	7.69	8.00	16.16	58.88
Bokhara Clover (*Melilotus alba*)	8.75	7.39	3.65	17.85	14.04	57.07

The above analyses show that these native grasses vary considerably in composition, but that they compare very favorably with cultivated ones.

The forage problems awaiting solution are numerous, and the farmers and stock men are just beginning to realize the importance of work along these lines. It has frequently been urged by the Chief of the Division of Agrostology that more exact and definite data on many of our wild grasses and more experimental work in the improvement of the native grasses are needed. If by selection from the native grasses an improved form of Western Wheat-grass or Grama grass can be introduced into the "semi-arid" region which will give greater returns than those already there, the live-stock industry will be put on a better basis and its success assured.

LIST OF THE MORE IMPORTANT GRASSES AND FORAGE PLANTS OF IOWA, NEBRASKA, AND COLORADO, WITH ECONOMIC NOTES.

Alfalfa (*Medicago sativa*) (fig. 1): This valuable legume is spontaneous only in the most favored places in central Iowa, but is more frequent from Carroll west, especially in the loess soil along the Missouri. The fact that it persists for some years is evidence of adaptability. As a cultivated plant, it has met with moderate success in a few places in Carroll, Audubon, Monona, Woodbury, Pottawattamie, and Harrison counties. I saw several good-sized fields in the Missouri River bottom, near Sargent's Bluff, in Woodbury County. The first crop was ready to cut by the 18th of June. The Missouri bottoms are favorable to the growth of alfalfa because permanent water is reached at a depth of 10 to 12 feet. The only difficulty in the way is that these bottoms are subject to overflows; the water during some seasons stands for days on the soil in low places. It is possible that the higher locations might be admirably suited for the growth of this crop. In fact, good crops were observed on the higher lands. The soil of the bluffs along the Missouri is commonly known as "loess." It is not peculiar to western Iowa, but occurs abundantly along the Mississippi and other Iowa streams. Loess is a fine homogeneous soil, free from pebbles or other adventitious matter, very friable, so much so that it may be turned with the spade. It stoutly resists weathering, and stands in vertical faces for years. Though the surface dries quickly, this soil retains water in a remarkable manner.

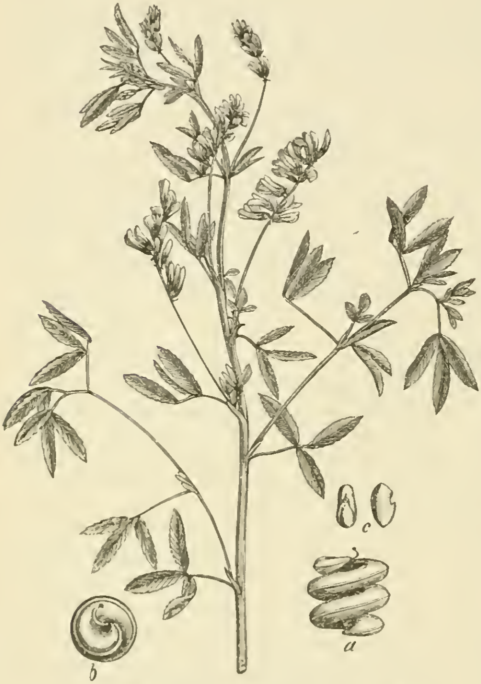


FIG. 1.—Alfalfa (*Medicago sativa*): *a*, seed pod seen from the side; *b*, seed pod seen from above; *c*, seeds.

These loess bluffs rise rather abruptly from the rich and fertile Missouri bottoms and extend as undulating hills for several miles east. In this region, which is comparatively narrow, a peculiar vegetation exists, peculiar at least for the State of Iowa. It is more western than eastern. It is here that alfalfa has succeeded best, and is perhaps destined to play an important part in the agriculture of the counties bordering on the Missouri. There are some difficulties to contend with in Carroll and Harrison counties, and this is true also to some extent in Pottawattamie County. The humidity of the atmosphere is somewhat greater than in Woodbury County. Accompanying this humidity there is a greater rainfall, and a greater rainfall makes the plant more subject to the attacks of the Spot Disease (*Phacidium medicaginis*). This fungus disease causes a premature falling of the leaves, and hence lessens its value as a forage plant.

Alfalfa is the most valuable acquisition to the leguminous forage plants of Nebraska. The frequency of naturalized specimens throughout the region in which I made observations certainly indicates that the plant is at home. Fine fields of it were observed not only in the lowlands along the Republican Valley, but also on the uplands. Its culture, however, was most successful on the flood plains of the river and under irrigation. It produces a fair crop without irrigation some years, but on the uplands, year after year, it can not be depended on. In the Republican River Valley the water level is from 8 to 10 feet below the surface. The roots easily reach this depth. Under favorable conditions three crops can be cut in a single season, but where the field is irrigated three crops are certain, and I was informed that it affords almost twice as much money return per acre as corn. A farmer with 40 acres of irrigated alfalfa can make a comfortable living in this part of the State. In the country east of the semiarid region considerable alfalfa has been grown, and, so far as I was able to learn, with good success. No other perennial forage plant has given to the farmer of this region the same amount of satisfaction as has alfalfa. It is certainly destined to play an important part in the forage problem in Nebraska.

Alsike Clover (*Trifolium hybridum*) is occasionally grown in Iowa, but is not as yet common. It is spontaneous in many places and is best suited for rather low grounds, frequently associated with White Clover and Red-top. It will probably never take the place of Red or White Clover in the State.

Barnyard-grass (*Panicum crus-galli*). This grass, although usually regarded as a weed, is frequently used as a forage plant in western Iowa. It occurs abundantly as a roadside and garden weed in central Iowa, and is a conspicuous grass in sloughs and in cornfields in the Missouri bottoms. Hundreds of tons of this grass might have been cut in Iowa this year. It is not always so plentiful, since the rains are usually less frequent in July and August.

Bearded Wheat-grass (*Agropyron caninum* R. & S.) is common in northwestern Iowa. It contributes somewhat to the native hay, but is of little value. In Colorado it is also common, even at an altitude of 9.500 feet. It is not so large as Slender Wheat-grass and grows in drier places. A closely allied species, *A. richardsoni* Schrad., occurs also in the mountains and compares favorably in forage value to *A. caninum*. Wire Bunch-grass (*A. divergens* Nees) is common in Clear Creek Canyon, near Golden, Colo., and is a grass of considerable value.

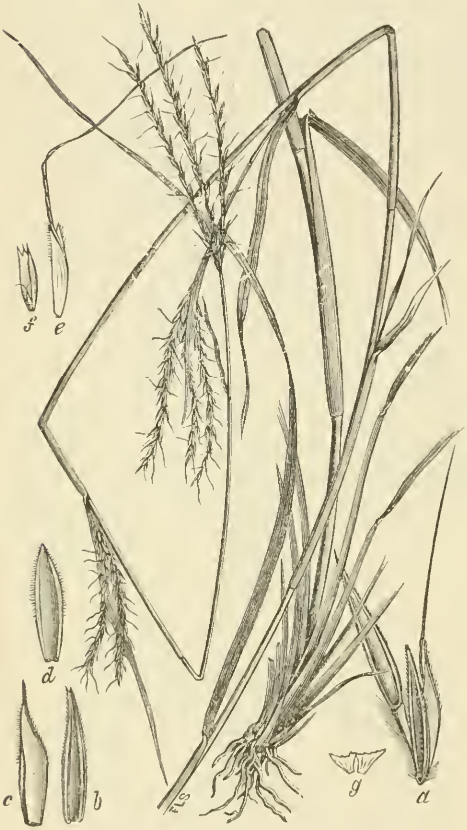


Fig. 2.—Big Blue-Stem (*Andropogon provincialis*): *a*, a pair of spikelets; *b*, first empty glume; *c*, second empty glume; *d*, third glume; *e*, fourth or flowering glume; *f*, palea; *g*, lodicules.

Big Blue-Stem (*Andropogon provincialis* Lam.) (fig. 2) is a common species throughout central and western Iowa. Wherever a bit of prairie remains this grass grows in abundance. It is a variable species, growing in bunches 3 to 8 feet high, and producing a large number of fine leaves. It occurs on the high, rolling prairie, rocky, open, wooded hillsides, and along the alluvial creeks and river bottoms. Blue-Stem is an important factor in the wild hay made in the Missouri bottoms, especially in the northwestern part of Iowa. It is liked by stock both as green forage and as hay. For horses many farmers prefer it to timothy. Blue-Stem hay brings a higher price in the market than any other wild hay. The grass was common about Lincoln, Nebr., and was observed as far west as McCook. It is a most excellent grass for the moister portions of the State, producing a large percentage of the wild hay as well as affording much of the pasturage. Near McCook, Nebr., it produced a fine growth in the flood plain along the Republican River. It requires a richer soil than the Turkey-foot grass.

Big Sand-grass (*Calamovilfa longifolia* Scribn.) is not common in central Iowa, though rather common in northwestern and western Iowa, where it abounds along railroads, on dry sterile soil, and steep hillsides. It often does good service in binding the loose soil together. As a forage plant it is of little value, the culms and leaves being very tough. In Nebraska it is common in the sand-hill country and also in the sandy marshes of the Republican Valley.

Black Grama (*Bouteloua hirsuta* Lag.) is common in the sand-hill region of western Nebraska. It forms dense tufts of fine leaves. It is nutritious, like the other gramas, and fills an important place on these poorer soils.

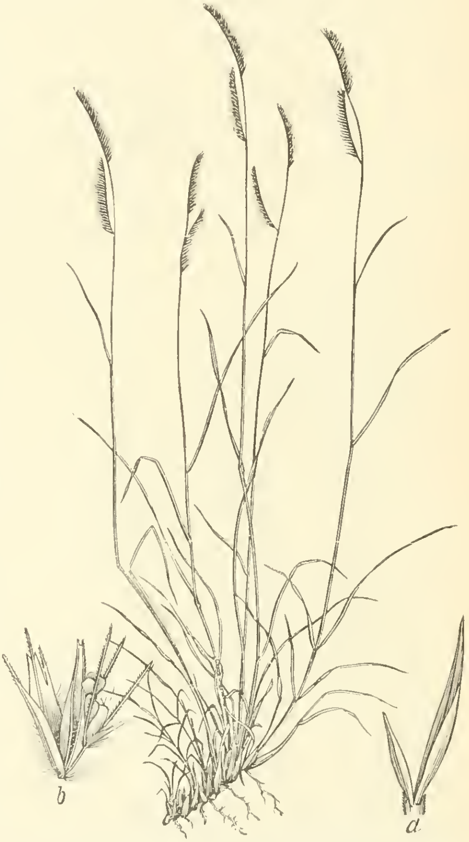


FIG. 3.—Blue Grama (*Bouteloua oligostachya*): *a*, empty glumes of a spikelet; *b*, spikelet with the empty glumes removed.

Blue Grama (*Bouteloua oligostachya* Torr.) (fig. 3) grows from 8 to 18 inches high, varying somewhat with seasons. It was much taller on the average in 1896 than in 1895. As a rule this grass seldom exceeds a foot in height. It is endowed by nature with great drought-resisting qualities. Around Crete and Lincoln, Nebr., it is common on dry soil and on gravelly knolls. At Hastings, Nebr., it is a dominant grass in meadows and pastures. The same may be said of it from McCook to the west line of Nebraska. As a pasture grass it is excellent, being nutritious and standing trampling better than Western Wheat-grass. A few years of selection under cultivation would no doubt produce a form equal to many of our cultivated grasses. Stockmen inform me that cattle thrive on this grass all winter in western Nebraska. In Colorado it is common in the foothills, especially between 5,000 and 6,500 feet altitude. Some plants were seen on an open prairie in northern Colorado at an altitude of 7,000 feet. Near Golden it was likewise observed at an altitude of 7,000 feet. It is common also at Colorado Springs, north of

Cheyenne Canyon, at an altitude of 6,500 feet. It usually grows much shorter than at lower altitudes.

Blue-joint (*Calamagrostis canadensis* Beauv.) is plentiful in Iowa only in low swales and second bottoms, where it commonly grows from 3 to 4 feet high, forming an abundance of leaves, well liked by all kinds of stock. The leaves keep green till late in the season, and the hay is not objectionable because the leaves and culms are not dead at the time when hay is usually made, as is often the case with Wild Rye.

Broom-corn Millet (*Panicum miliaceum*) is seldom cultivated in the central district of Iowa, though used more extensively in northern and northwestern parts of the State. It does well in dry years, and as a productive crop should commend itself.

Buffalo Bunch-grass (*Festuca scabrella*). This species at higher altitudes is the bunch grass par excellence. It is abundant on the Little Beaver in northern Colorado, at an altitude of 9,500 feet, where it occurs in open, sunny places and grows from a foot to 4 feet in height. The blades are often a foot long. The whole plant is more or less glaucous, which adds to its striking appearance. Professor Crandall, who is familiar with the plants of this region, states that several years ago, when stock had not grazed so far up the mountains, this grass occurred in great quantity in the open, sunny places at an altitude of 9,500 feet. Very few good specimens could be found, because almost every blade had been closely cropped. The Rocky Mountain Husbandman has this to say of Bunch-grass:

> The cured grass retains its nutriment all winter, owing to the fact that we have no drenching rains in the fall to bleach it—the light snows which come in early winter and melt off soon only serving to moisten it and make it more palatable. When we have late summer rains and the grass remains green until fall, should frost come early it is injured and stock do not seem to keep in such good condition during the winter as when it dries up early, as is generally the case. During the winter the lowlands and sharp foothills are for the most part free from snow. Usually the snow is cleared away by the wind except that which is driven into the thick clusters of grass. * * * In grazing the stock gather up more or less snow, which serves in great measure as a substitute for water. With the disappearance of snow in the spring, stock go up into the foothills, following the receding snow line. The grass which lies covered all winter is relished best. Besides, the young crop starts first and grows fastest among the steep hills.

What is here said of Buffalo Bunch-grass applies also to Montana and Idaho, where it grows at lower altitudes. This grass has received the same high appreciation by stockmen everywhere.

Buffalo-grass (*Bulbilis dactyloides* Raf.) (fig. 4) once extended farther east than now, since it is reported from northwest Iowa. I did not, however, meet with it in that part of the State, nor did I observe it east of Lincoln, Nebr. At Lincoln small patches occur. It is abundant about Hastings, Nebr., where, in some cases at least, it is the chief pasture grass. It is common about Oxford and

McCook, Nebr., and westward to the Nebraska line, although at no point was it so finely developed as on the beautiful prairies surrounding Hastings. Buffalo-grass is certainly adapted to the semiarid belt and to the western part of the humid prairie region. Farmers agree that it is exceedingly valuable, not only because of its nutritious qualities, but the close turf retains the moisture and allows the plant to develop under conditions adverse to most plants, certainly to our cultivated grasses. Every effort should be made to retain this grass. In central and southwestern Nebraska it is not only a valuable summer forage, but the mild winters make it especially desirable for winter grazing. When used for this purpose it should not be cropped too closely in the summer. The farmer should recognize the importance of not overstocking the ranges. He should give this and other grasses time to produce seed, so that they may perpetuate themselves by seeds from the most vigorous plants. Buffalo-grass seeds freely, and this is one of the most important points in its favor. In Colorado I observed it only in the lower foothills, where it is a valuable grass. It grows in the same way as on the plains, forming large mats and patches of turf, which are closely cropped by stock.

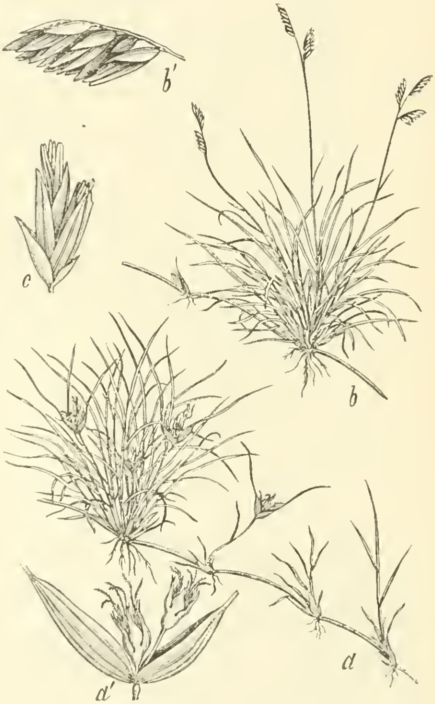


FIG. 4.—Buffalo-grass (*Bulbilis dactyloides*): *a*, female plant; *b*, male plant; *a'*, two clusters of female spikelets; *b'*, a branch of several staminate spikelets; *c*, a male or staminate spikelet of two flowers.

Buffalo Pea (*Astragalus caryocarpus* Ker.) is common on the prairies of Nebraska and dry, sterile hills of central and western Iowa. It is valuable as a forage plant.

Bunch-grass (*Sporobolus heterolepis* Gray) is the most valuable of the several Drop-seed grasses that abound in central and western Iowa. This beautiful species occurs on high or low prairies and hillsides with Little Blue-Stem and Switch-grass. It grows in bunches and produces large numbers of slender leaves close to the ground.

Bunch Spear-grass (*Poa arida* Vasey) comes up quite abundantly in the meadows of arid pastures in the Republican River Valley, Nebraska. It somewhat resembles Blue-grass, with sharp-pointed leaves and a more scant growth. It flowers early, and hence when hay is cut it is past its season.

Bushy Blue-Stem (*Andropogon nutans* L.) is a tall perennial found in open woods and prairies in Iowa and eastern Nebraska, but is less common than the other blue-stems. It is cut late in the season, usually in August or September, because then more easily made into hay. The hay is palatable and nutritious, and cures well. Though the quantity would be less if cut by the middle of August, the quality would be superior.

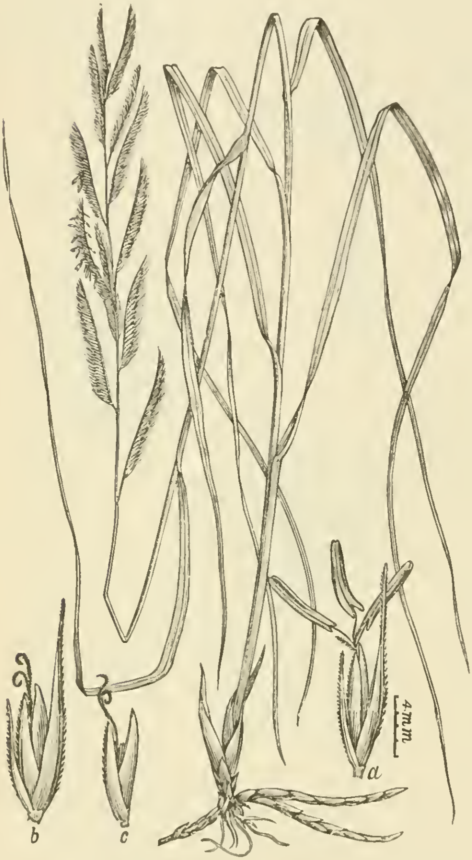


FIG. 5.—Fresh-water Cord grass (*Spartina cynosuroides*). *a*, spikelet showing three stamens; *b*, spikelet showing the projecting stigmas of the pistil; *c*, the same with the outer glumes removed.

California Oat-grass (*Danthonia californica*) is abundant in the pine woods and meadows of northern Colorado at an altitude of 8,000 feet. It grows in bunches from 1 to 3 feet high, has soft foliage, and is one of the valuable mountain grasses. It is much eaten by stock, and forms a considerable element in the forage of the mountain "parks" and meadows.

Colorado Blue-Stem (*Agropyron spicatum*) is one of the two valuable grasses of this genus that are native to Iowa. It is common on the loess in western Iowa, where it is used for both hay and pasturage. As an introduced plant it is now common at many points in central Iowa and is spreading rapidly. In Iowa it grows more vigorously than it does in Nebraska, where it attains a height from 2 to 4 feet. It is bluish green in color, with somewhat harsh leaves. The thriftiness of this grass in new meadows as well as in the vicinity of plowed ground indicates that an occasional stirring is beneficial. I am assured that it is not difficult to start a good meadow of this grass in two or three years on plowed ground. It grows along with such grasses as grama and other prairie species. Meadows of considerable extent occur between Crete and Hastings, Nebr. It is quite a novelty to see hundreds of acres with the conspicuous blue-green color of this grass. It is common in the foothills in central and northern Colorado, and about Golden and Colorado Springs. It is not uncommon in open places at an altitude of 7,000 feet, but is much more abundant at 5,000 and 6,000 feet.

Cord-grass (*Spartina cynosuroides* Willd.) (fig. 5) is abundant in low grounds, and is an important feature of the meadows in western Iowa along the Missouri. It is well suited for the alluvial soils of this region, and can endure standing water better than Big Blue-Stem. Nature has adapted Cord-grass to low and swampy places. The reserve material stored in the root stocks enables it to grow rapidly when the water has receded. Many farmers hold this grass in high esteem. One farmer informed me that it was more valuable than Big Blue-Stem. For the Missouri River region it is a most profitable grass. In Nebraska it is common in low grounds from Omaha to McCook. It is of little value as a pasture grass, and is commonly cut for early hay.

Couch-grass (*Agropyron repens* Beauv.) is naturalized in many places in Iowa, and is often cut for hay. It starts early in the spring and produces a large number of fine leaves. In frequent rotations it is a pest rather than a valuable forage plant. In soils much subject to wash it has proved of value as a soil binder. It occurs as an introduced plant in Nebraska about Omaha and at McCook, but is much inferior to its western relative.

Crab-grass (*Panicum sanguinale* L.) is abundant throughout Iowa in cultivated fields and open places in blue-grass pastures. Usually regarded as a weed, but may afford some picking in cornfields after corn is removed. Under such conditions, however, the forage is of poor quality.

Downy Oat-grass (*Trisetum subspicatum*) is abundant in Colorado in dry open woods and open places. It is one of the first grasses to appear after fires have swept the forests.

Early Bunch-grass (*Eatonia obtusata*) grows in rather moist prairies throughout Nebraska. It matures early and produces only a small quantity of leaf and stem, and hence is not as important a factor in the production of either hay or green forage as is Prairie June-grass.

Feather Bunch-grass (*Stipa viridula* Trin.), although not indigenous to central Iowa, has been found spontaneous along the railroad west of Ames. It grows in bunches, seeds freely, and is much more palatable than Porcupine-grass. It might be introduced with advantage on the loess soils of western Iowa. In Nebraska it was observed in considerable quantity on the second bottom along the

Republican River and on the upland prairies. It is less objectionable on account of its "spears" than Porcupine-grass and Needlegrass. The leaves are softer and retain their nutritious qualities longer. It is well adapted to this section of Nebraska. In Colorado it is abundant, not only at an elevation of 5,000 feet in the vicinity of Fort Collins, but near Colorado Springs and Golden it abounds up to an altitude of 8,000 feet. It is one of the most valuable forage plants of the foothills.

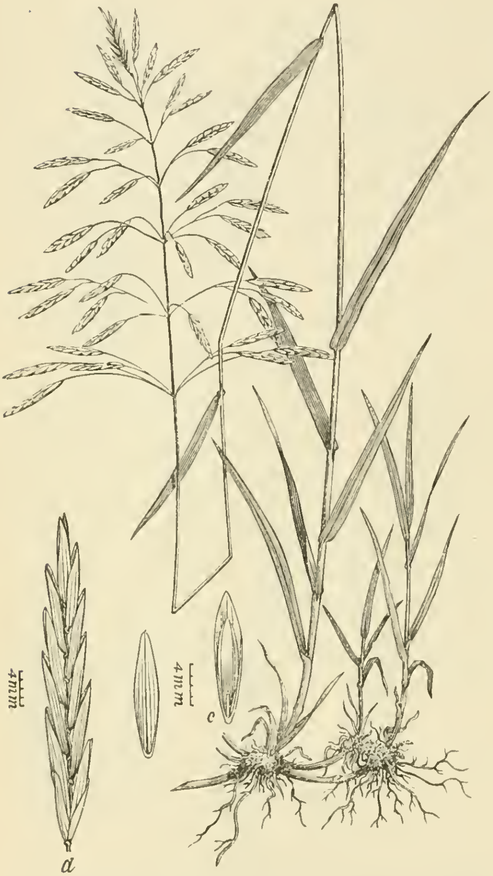


Fig. 6.—Hungarian Brome grass (*Bromus inermis*): *a*, spikelet; *b*, flowering glume seen from the back; *c*, floret seen from the anterior side, showing palea.

Fowl Meadow-grass (*Poa flava*) is not uncommon on the flats and along the smaller streams in western and northwestern Iowa. It would be of greater value for hay if it could be harvested earlier. Under present conditions of making hay in August it has lost much of its valuable qualities. In Colorado this species occurs in wet grounds at lower altitudes than Blue-grass.

Foxtail or **Pigeon-grasses** (*Chætochloa viridis* S. & S. and *C. glauca* S. & S.) are abundant throughout central and western Iowa in cultivated fields and in open places in Blue-grass pastures. Though usually regarded as weeds, they afford some picking in cornfields after the corn is removed. Under these conditions, however, the forage is of very poor quality.

Giant Rye-grass (*Elymus condensatus*) is abundant in Colorado, at an elevation of 5,000 to 5,500 feet. Cattle seem to prefer the shorter grasses to this large coarse species. Professor Lamson-Scribner speaks of it as an excellent winter forage plant in California. A second species (*Elymus triticoides*) was observed in spruce and pine woods in Clear Creek Canyon. It is of some value in the sparsely wooded areas of this region of Colorado.

Hungarian or **Smooth Brome** (*Bromus inermis* Leyss.) (fig. 6) withstands drought and cold, and is perfectly adapted to conditions existing in Iowa. It makes excellent growth and more nearly reaches the ideal of a farmer's grass than any other sort introduced in recent years. Under favorable conditions two crops can be cut in a single season, and the aftermath is excellent. Hungarian Brome commends itself to the farmers of central and western Iowa. This is the Russian grass or Russian Brome-grass of some writers.

Kentucky Blue-grass (*Poa pratensis* L.) (fig. 7) is the chief pasture grass of central and western Iowa, though not so prominent in northwestern Iowa. It does fully as well in and about Jefferson, Carroll, and Logan as in northeastern, southwestern, and southern Iowa. Southwestern Iowa has sometimes been called the Blue-grass region of the State. The spring of 1896 in central Iowa was early, and in many cases cattle were turned into the pastures before the 1st of May, from which time to the 15th of July this grass is generally at its best. Although checked by a short midsummer drought, a vigorous growth was induced by rains in the latter part of July, so that during August and September pastures looked as green as they did in May. It is not uncommon for many farmers to feed in August, but the excellent condition of the grass pasture rendered this entirely unnecessary in 1896.

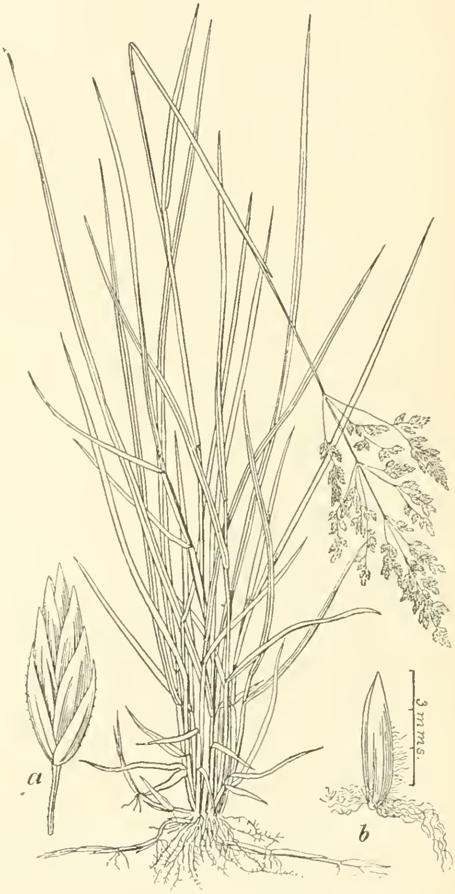


Fig. 7.—Kentucky Blue-grass (*Poa pratensis*): *a*, a spikelet; *b*, the floret, showing the hairs or wool at the base.

In 1895, and especially 1894, because of the great drought in Iowa, many farmers fed green corn fodder in August. Blue-grass can not, therefore, be depended on every season, but it is reliable and safe as a pasture grass most seasons. Green corn fodder is a safe substitute, and every farmer should have some corn which can be used to feed in July and August when necessary. Some farmers in central Iowa advocate the more extended use of corn fodder for this purpose. They believe that less area should be devoted to the grass pasture. A Blue-grass turf is a producer of wealth, and if properly managed increases in importance as the country becomes older. Short rotation is not advised, though many farmers get excellent results by planting Blue-grass seed in the cornfields. In the spring of 1895, and especially the fall of 1894, many farmers were disheartened because of the many vacant spots left in the pastures. These were soon occupied by Squirrel-tail grass, or Wild Barley, and Pepper-grass (*Lepidium apetalum* Willd.). These pastures have entirely recovered during the past season.

The subject of Blue-grass should not be passed without saying something of its use in the central section of the State as a winter forage plant. When speaking of winter pasturage in Iowa, the farmer refers to Blue-grass. It is a well-known fact that cattle do remarkably well on this grass in the winter. Though it has lost in nutritive qualities, it is highly relished and serves a most excellent purpose in keeping the digestive organs of the animal in good condition. With a good winter pasture of Blue-grass it will be unnecessary to use the "stock foods" to regulate the organs of secretion. Farmers should not lose sight of the fact that overstocking is injurious. To be in good condition for the winter it should not be overstocked in September and October. Other grasses have been tried in this way. Texas Blue-grass has received considerable notoriety in this respect, and while perfectly hardy at Ames, Iowa, nothing can be said about its use in central Iowa for this purpose, since it has not been extensively tried.

The composition of winter-grown and summer-grown Blue-grass, according to analyses made at the Iowa Experiment Station by Prof. G. E. Patrick and Mr. C. M. Wade, is as follows:

Analyses of winter-grown and summer-grown Blue-grass.

Constituents.	Winter-grown Blue-grass.		Spring and summer grown Blue-grass.		
	3 to 7 inches high, gathered Nov. 24, 1890.		3 to 6 inches high, gathered Apr. 28, 1890.	Early bloom, gathered July 28, 1890.	Just after bloom, gathered June 7, 1890.
	Green.	Dried.	Green.	Green.	Green.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Water	61.73	23.05	68.05	62.91	61.24
Dry substance	38.27	76.95	31.95	37.09	38.76
Dry substance:					
Ash	9.32	12.41	11.49	8.47	8.66
Fat	4.69	4.24	5.55	2.25	2.75
Nitrogen-free extract or carbohydrates	51.49	48.40	42.74	50.50	50.79
Fiber	19.61	26.56	22.19	29.11	29.92
Protein	14.89	8.39	18.03	9.67	7.88

In eastern Nebraska Blue-grass is a success, thriving best on low grounds along rivers, but also giving good returns on the drier uplands. The season of 1895 was unfavorable for it in central Nebraska, but in 1896 the pastures were in excellent condition. The species was observed at Hastings and McCook. In the latter place it occurred in the streets and also in the flood plain of the Republican River. One of the finest Blue-grass lawns I have ever seen was noticed in Oxford. This was, of course, under irrigation. In the mountains of Colorado it forms an excellent turf. The meadows were as green as any in Iowa in May.

Large Rush-grass (*Sporobolus hookeri* Trin.), which is found on poorer soil than Bunch-grass, forms a dense turf. The leaves and stems are tough and wiry, detracting from its value as a forage plant. *Sporobolus cryptandrus* Gray is an earlier grass, likewise somewhat tough when old, not so common as Bunch-grass or large Rush-grass. *Sporobolus brevifolius* is one of the commonest grasses of the loess of western Iowa. It forms a dense mat of interlacing roots and root stocks, effectually preventing the washing of the soils. It also occurs near Carroll, Iowa. The species is of little value as a forage plant. Another species of this genus is common throughout this section of Iowa—Southern Poverty-grass (*S. vaginæflorus*). It occurs in fields and along roadsides, and is usually avoided by stock. During the dry seasons of 1894 and 1895 farmers complained of its presence in pastures.

Little Blue-Stem (*Andropogon scoparius* Michx.) is common in central and western Iowa. It grows on the poorer sandy soils, although in western Iowa it occurs abundantly on the loess bluffs, constituting a large share of the natural forage. It has the habit of forming bunches, and grows from 2 to 3 feet high, with a large number of root and stem leaves. It seeds more freely than Big Blue-Stem. Stock will eat the grass when it is young and fresh, but when old it becomes woody and unpalatable. It is common on the loess of eastern Nebraska about Omaha, and was also observed about Lincoln and Crete.

Loco Weed (*Oxytropis lamberti*) is of no value as a forage plant. Although the plant was common everywhere in Nebraska, I heard no complaints about it. In Colorado it is the most conspicuous and common of the *Leguminosæ*, but it is seldom eaten by stock.

Lupinus plattensis Watson occurs in sandy bottoms along the Republican River in Nebraska. It showed evidence of having been eaten by stock.

Manna grasses (*Panicularia* species). Several species occur in Iowa. *P. nervata* and *P. aquatica* are most common. These species are of value only in wet meadows and pastures.

Meadow grasses (*Poa* species) are common throughout the mountains of Colorado. At higher altitudes and lower down in moist canyons Wood Meadow-grass (*Poa nemoralis*) is abundant, as is Bunch Red-top (*Poa buckleyana* Nash). These species are not so valuable as *Poa wolfii* Scribner, which is common in dry woods in Clear Creek Canyon, where it is one of the more important grasses. *Poa lettermannii* is common above timber line on Pikes Peak. *Poa rupestris* is likewise common. These poas constitute some of the most valuable grasses in all of the mountain meadows. *Poa wheeleri* Vasey is another valuable grass of this genus found at an altitude of 7,800 feet. Mountain Spear-grass (*P. alpina*), at an altitude of 10,000 feet to timber line, forms a large cluster of leaves close to the ground.

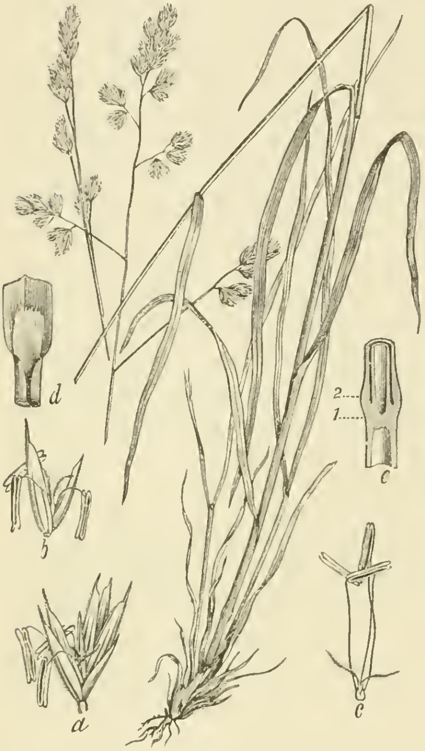


FIG. 8.—Orchard-grass (*Dactylis glomerata*): *a*, a spikelet with one of the florets expanded in flower; *b*, the floret; *c*, the flower, consisting of three stamens and pistil with two feathery stigmas; *d*, the upper portion of the leaf sheath and the lower portion of the leaf blade, showing ligule; *e*, section of the stem or culm at one of the nodes, 1, node proper; 2, the swelling enlargement of the basal portion of the leaf sheath.

Millets (*Chætochloa italica* and var. *germanica*). No other grasses are so productive on Iowa soil as the millets. Some farmers sow these grasses every year. As a rule, however, they are sown as "catch crops" in the latter part of June or early July, when by September a good crop of hay can be made. Some farmers are prejudiced against the millets because of the danger to stock when consuming large quantities of seed. When rightly managed, there need be little danger from this source. Millets are extensively grown in both eastern and western Nebraska. They do well in nearly all parts of the State. Fine fields were noted near Omaha, Crete, and Hastings, and also near McCook, at an altitude of 2,500 feet.

Needle-grass (*Stipa comata* Trin. & Rupr.) is common in Nebraska about McCook and westward, at an altitude of 2,500 to 3,000 feet. This grass grows on the high prairies. It is of forage value only under the same conditions as Porcupine-grass. In Colorado it is common in places in the foothills about Golden, Fort Collins, and Colorado Springs. It is not so valuable as Feather Bunch-grass, but adds to the list of plants available for forage purposes.

Orchard-grass (*Dactylis glomerata* L.) (fig. 8), though well known as a valuable grass, is seldom sown. Few farmers in this section of the State are acquainted with it. It is not uncommon along roadsides and in dooryards, giving evidence of adaptability to soil and climate. Although not generally cultivated in Nebraska, it is of frequent occurrence about Omaha, Lincoln, Crete, Hastings, and McCook. In all of these places it grows without irrigation, and the fact that it grows so well certainly indicates adaptation. Orchard grass is not, however, to be recommended for western Nebraska except in canyons and on the flood plains of streams. In eastern Nebraska it should come into general favor.

Porcupine-grass (*Stipa spartea* Trin.) is as common on the dry, sterile hills of central Iowa as it is in western Iowa. It has the habit of growing in large bunches, from $1\frac{1}{2}$ to $3\frac{1}{2}$ feet high, with leaves often more than a foot long. It is useful as a pasture plant only early in the season or when kept closely cropped. It is often troublesome after the 10th of June, since the barbed "seed" is then either forming or ripe, and is liable to inflict injury to sheep. The danger from this has become less in recent years, as the grass rarely regains its hold upon cultivated soil. After the "spears" have fallen the grass may be cut for hay. In Nebraska it is common only in the eastern part, occurring on high prairies and the slopes of hills. Although regarded as a pest in pastures, it is valued as a hay grass.

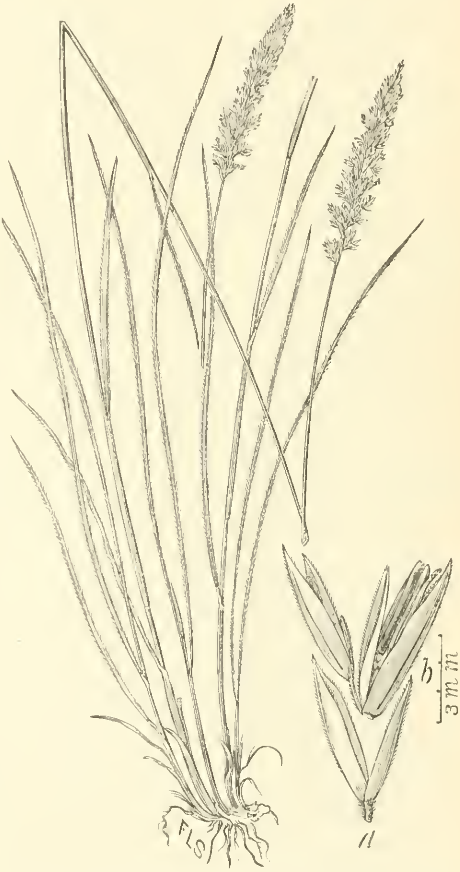


Fig. 9.—Prairie June-grass (*Koeleria cristata*): *a*, empty glumes; *b*, the two florets raised above the empty glumes.

Prairie June-grass (*Koeleria cristata* Pers.) (fig. 9) grows abundantly on the prairies and dry hills of Nebraska and Iowa. It comes on early and retains its nutritious qualities even after the leaves become dry. It is common about Omaha, Crete, and McCook. In Colorado it is one of the most abundant of the grasses in dry places in the foothills. Great quantities of it were observed near Fort Collins and Golden and at Colorado Springs, at an altitude of 7,000 to 8,000 feet. It was closely cropped, showing evidences of being relished by stock. Though an insignificant grass, so far as bulk is concerned it is one of the more valuable species of the foothills.

Red Clover (*Trifolium pratense*) is the chief leguminous forage plant of central and western Iowa. It is not quite as successful in the northwestern part of the State as further east, yet fine fields were observed near Sioux City the past season. Farmers sow the seed in early spring, either with or without a nurse crop. Nearly every farmer has his clover patch. It is used as a fertilizer as well as a hay crop. The first crop is cut for hay, while the second is often used for seed. It is a common practice to pasture after hay has been removed.

Red-Top (*Agrostis alba*) grows wild in low grounds, although it is seldom sown. It makes excellent hay, but as yet is not much of a factor in the forage of the State. It is a valuable grass in eastern Nebraska, especially in low ground, where it has been tried by many of the farmers, and is more common, as a naturalized plant, than Orchard-grass. It was observed in western Nebraska about McCook, in the Republican Valley, where it seems to be a most valuable addition.

Reed Canary-grass (*Phalaris arundinacea*) is more common and of greater value as a native forage plant under present conditions than Wild-Rice or Reed-grass. It matures early, produces a large number of bright green leaves that may be used with considerable advantage for hay in June. The soil in which it grows is often so wet, however, that the stock obtain it with considerable difficulty. The leaves remain green for some time after the seed has formed. It is common near Jefferson, Council Bluffs, Missouri Valley, and Sioux City, Iowa.

Reed-grass (*Phragmites vulgaris*) was once abundant and is still common in western and central Iowa, about old lake beds and marshes. It is of little value as a forage plant. In Nebraska it is common in very wet marshes along streams. Specimens from 12 to 14 feet high were observed near McCook.

Rye (*Secale cereale*). Farmers do not fully appreciate the great value of rye as a forage plant. It is used to a large extent and fully meets the requirements for fall, winter, and early spring pasturage. It is usually sown in the fall, and as soon as it is 4 or 5 inches high it will stand a moderate amount of grazing, which can be kept up through the winter and early spring. In the spring it affords a greater abundance of pasture than Blue-grass. Farmers who have used it commend it most highly for this purpose. One farmer complained that butter acquired a peculiar taste when the cows were fed on rye, but that was probably due to some other cause.

Sheep's Fescue (*Festuca ovina* L.). Several forms occur in the foothills of Colorado. On the steep sides of rough and rocky mountains it grows in small bunches with numerous firm leaves. Here it is a most valuable grass.

Short-awned Brome (*Bromus breviaristatus* Thurb.) (fig. 10) has been introduced and grown for a number of years in central and western Iowa. The results have been very satisfactory. Two crops may, under favorable conditions, be cut in a single season. It is nearly as valuable as Hungarian Brome, and is worthy of a more extended trial. In Colorado it is common in some gulches in the vicinity of Fort Collins at an altitude of 6,000 feet, and is equal in point of vigor to Hungarian Brome-grass. It produces an abundance of large, soft leaves, and the forage is well liked by stock.

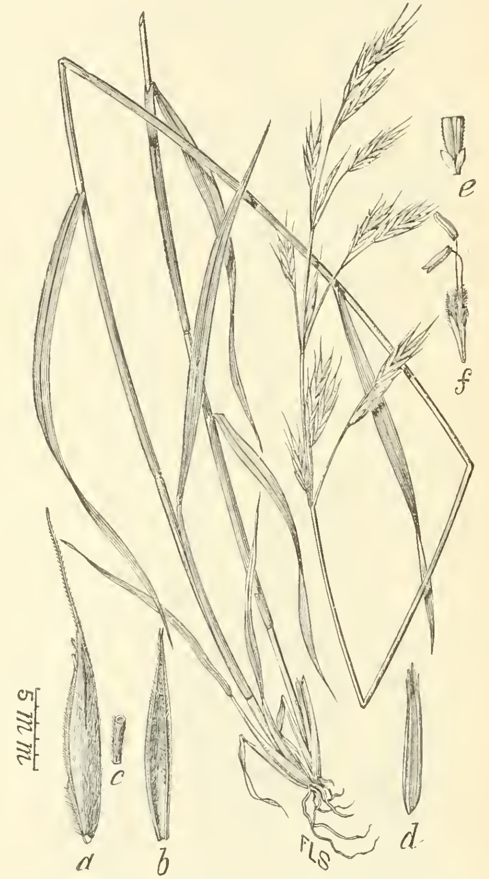


FIG. 10.—Short-awned Brome-grass (*Bromus breviaristatus*): *a*, the floret seen from the side; *b*, palea; *c*, joint of the rachilla; *d*, grain; *f*, young seed or grain; *e*, lower portion of pistil, showing lodicules.

Side Oats Grama or **Tall Grama** (*Bouteloua curtipendula*) (fig. 11) is common on hills in central and western Iowa. It is a valuable grass of the loess, occurring abundantly on rather dry soils. The hay made from it is of the very best quality. It cures readily, and even when cut late in the season the leaves retain their freshness longer than many other wild grasses. It occurs throughout Nebraska, but was apparently most abundant in the eastern half of the State. It makes a fine growth of leaves, and is highly prized by farmers for hay and grazing.

Sleepy-grass (*Stipa robusta* Scribn.) is common at altitudes of from 5,000 to 5,500 feet, growing in large patches. Although cattle are numerous everywhere in this region, they apparently do not touch this grass. It flowers much later than Feather Bunch-grass (*Stipa viridula*).

Slender-Fescue (*Festuca octoflora* Walt.) was observed not only in the foothills about Fort Collins, but also at Golden and Colorado Springs, Colo., from 5,000 to 9,000 feet. It is an annual, and in dry soil rarely attains a height of more than 4 inches, but in more sheltered and moister places it reaches a foot in height. This grass is at best of little value as a forage plant.

Slender Wheat-grass (*Agropyron tenerum* Vasey), mentioned as occurring along irrigation ditches throughout northern and central Colorado, is a valuable mountain grass. It grows in marshy meadows, attaining a height of 4 feet, with a large number of soft leaves and a long slender spike. It adds much to the forage of these mountain meadows, and would be far preferable to barley as a productive crop.

Squirrel-tail grass (*Hordeum jubatum* L.) is common in Iowa and Nebraska, but it may be questioned whether it should be included among the forage grasses. It grows everywhere in meadows and pastures throughout the State. Squirrel-tail grass affords some pasturage early in the spring and in the fall, when the young plants come up abundantly after the rains. If allowed to head out, it soon becomes a troublesome pest.

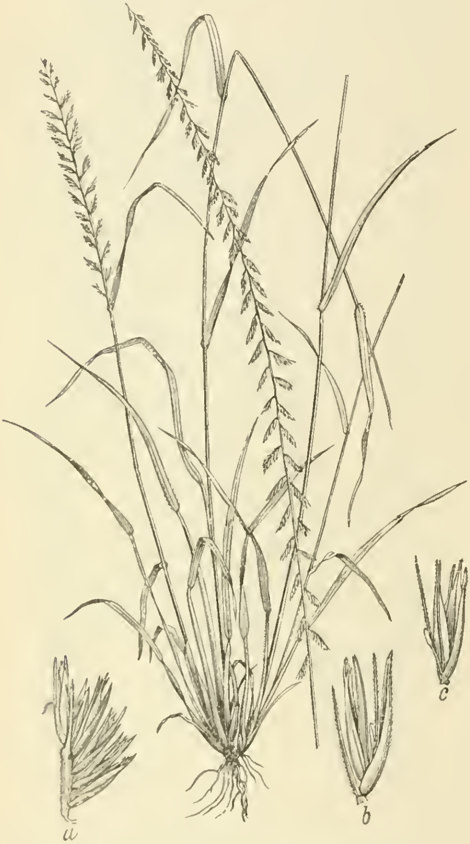


Fig. 11.—Side Oats Grama (*Bouteloua curtipendula*): *a*, one of the short spikes; *b*, a spikelet; *c*, a spikelet with the outer empty glumes removed.

Swamp-Chess (*Bromus ciliatus*) is of frequent occurrence in Iowa. The variety *purgans* matures its seed in June or early July, and occurs chiefly in woodland pastures where it is of considerable value. It is not as vigorous or as large a grass as the species, which matures in August. The latter has large culms and panicles with an abundance of leaves. This chess is certainly valuable for Iowa. It also occurs in eastern Nebraska, chiefly in woods and low meadows, where it affords considerable forage, and seems worthy of a trial under cultivation. In Colorado the variety *pungens* is one of the most common of this genus at an altitude 6,000 to 7,000 feet about Golden. It is especially common in pine and spruce woods. It grows as vigorously at this altitude as in Iowa.

Switch-grass (*Panicum virgatum* L.) is common and productive everywhere in central and western Iowa. It grows abundantly in native prairie sod and along railroads. It is by no means confined to the bottom land or the richer prairie soil, being frequently found on sandy or gravelly drift, but it affords more and better forage on the richer soil. It is used for both hay and pasturage, but is of much less value as a pasture grass than for hay. It has been tried in a small way under cultivation in central Iowa, with promising results. The trials have not been extended enough, however, to recommend it for general culture. In eastern Nebraska it is abundant on the prairies, river bottoms, and open wooded slopes, and it was observed as far west as McCook, where the common form had a bluish color.

Tall Oat-grass (*Arrhenatherum elatius* Beauv.) has been tried in Iowa, and although it stands drought and cold well and makes a good growth, it has not come into general cultivation.

Texas Crab-grass (*Schedonnardus paniculatus* Trelease) is a common species in western Nebraska, and also occurs near Lincoln and Crete. About Hastings, Oxford, and McCook it is abundant on the high prairies. It is also abundant in the sandy flood plains of the Republican Valley. Cattle apparently seldom eat it, except when the grass is young and tender.

Timothy (*Phleum pratense* L.) is the best known of our hay grasses. It is used but little as a pasture grass. The bulbous thickening of the rootstock is apt to be pulled out by cattle or injured by tramping. Farmers generally use it as a meadow grass, sowing it in early spring either with or without a nurse crop or with Red Clover. In the latter case the clover predominates the first season, but in the second and third seasons the timothy is more abundant and less rank than when grown by itself. Hay consisting of this mixture is excellent and is generally preferred to any other. Timothy is well adapted to eastern Nebraska, where it succeeds better on low grounds than on the higher prairies. I saw very fine fields in 1896. Timothy is one of the best known of the cultivated grasses of eastern Nebraska, and is fully as much at home here as in western Iowa. In Colorado it is frequent as an introduced grass in moist gulches and canyons at an elevation of from 5,000 to 7,000 feet. It also grows at a higher altitude, though not so common there. Mountain timothy (*Phleum alpinum*) grows in moist woods and marshes at higher elevations in northern Colorado, from 8,000 to 10,000 feet. Where cattle grazed this grass was closely cropped, and was of considerable value as a forage plant.

Triple-awned Beard-grass (*Aristida fasciculata* Torrey) grows in dry places between Omaha and Lincoln, Nebr., but west of Lincoln it becomes very common. This grass is of value only when young, as the stems and leaves soon become wiry and harsh. Though not considered of much value on the plains, it is not without merit in the foothills. It grows in small bunches, having numerous fine leaves.

Turkey-foot-grass (*Andropogon hallii* Hack.) (fig. 12) was observed only in the sandhill region of western Nebraska. Here it produces an exuberant growth, 4 to 6 feet high, with a large number of leaves. It should be cut early if used for hay. Cattle are fond of the grass when young and fatten on it. Many farmers believe that for range purposes the sandhills are much superior to the country east, and Turkey-foot is one of the most important grasses of the region.

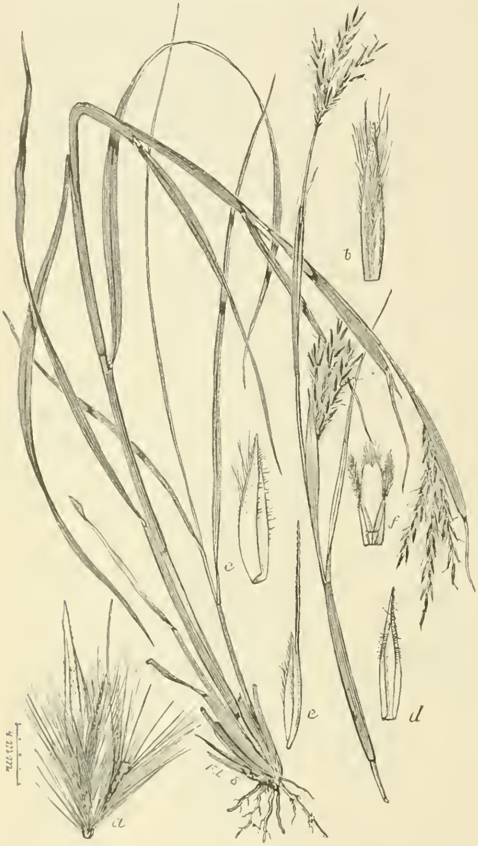


FIG. 12.—Turkey-foot-grass (*Andropogon hallii*): *a*, a pair of spikelets; *b*, the first empty glume of the sessile spikelet; *c*, second empty glume; *d*, the third glume; *e*, fourth or flowering glume; *f*, palea showing a pistil and lodicules.

Western Brome grass (*Bromus pumpellianus*) occurs in large patches, at an altitude of 9,500 to 10,000 feet. It is a striking green grass from 2 to 3 feet high, and forms a splendid turf. For cooler regions and in moist places this would no doubt prove valuable under cultivation.

White Clover (*Trifolium repens*) is a fickle plant in Iowa. An abundance of moisture is essential for its full development. When this condition is fulfilled it affords fine pasturage. Very few farmers ever sow white clover. In 1894 and 1895 it was not abundant, but in 1896 the Blue grass meadows were white with it in June. It has been suggested that the winters are too severe and the plants are killed. Periodical scarcity of white clover is more than likely to be associated with diminished seed production, caused by dry weather. The plant blossoms freely during moist weather, attracting the honey-bees, its chief pollinators. Moist weather accelerates seed production, as well as vegetative growth.

Wild Rye (*Elymus canadensis*) is very abundant on the prairies, low flats, and along the smaller streams in both Iowa and Nebraska. On valley lands it sometimes makes up more than half the wild hay. The forage is excellent when cut in time, but it is of little value as cut here in ordinary practice. It is usually cut in August, when the dead spikes stand out conspicuously among Blue-stem. There is often great danger in using such hay, as it frequently contains ergot—as many as eight or nine ergotized grains having been observed in a single head. The only safe course to pursue is to cut the grass in July, before the ergot has formed. In favorable seasons the meadow will produce a good second crop, which can be used as autumn pasture.

Wild Vetch (*Hosackia purshiana* Benth.), a native legume on low prairies in Nebraska, is a most valuable plant and worthy of cultivation. It has established itself in central Iowa, and is not uncommon on the loess region along the Missouri.

Wire grass (*Poa compressa* L.) is frequent in dry woods and in sterile soils in Iowa, and under such conditions is a valuable plant, forming a dense and close turf. It was observed in eastern Nebraska in the vicinity of Omaha and also as far west as McCook, in Red Willow County, where it grows without irrigation. It thrives in drier places and poorer soils than Blue-grass. This grass is worthy of encouragement, for though less productive than Blue grass, it furnishes good forage where better grasses will not grow.

LIST OF GRASSES COLLECTED IN IOWA, NEBRASKA, AND COLORADO.

The accompanying list is based on specimens collected at the following points:

In Iowa: Jefferson, Carroll, Carnarvon, Sioux City, Logan, Missouri Valley, and Council Bluffs.

In Nebraska: Lincoln, Crete, Oxford, and McCook.

In Colorado: Fort Morgan, Greeley, Fort Collins, La Porte, and other points in Larimer County. Along the tributaries of the Cache la Poudre River, Denver, near the mouth of Clear Creek Canyon, Golden, Colorado Springs, and North Cheyenne Canyon.

The higher altitudes as here given are based on field observations. The altitudes of lower points are based on Henry Gannett's Dictionary of Altitudes, and are approximate only for these places.

ANDROPOGONEÆ.

Andropogon nutans avenaceus Hack.

Iowa: Carroll, altitude 1,240 feet; Carnarvon, altitude 1,200 feet; Missouri Valley, altitude 1,022 feet.

A. provincialis furcatus (Muhl.) Hack.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,200 feet; Carnarvon, altitude 1,200 feet.

Nebraska: McCook, altitude 2,517 feet.

A. scoparius Michx.

Iowa: Sioux City, altitude 1,230 feet; Carroll, altitude 1,240 feet; Missouri Valley, altitude 1,030 feet.

PANICEÆ.

Panicum capillare L.

Iowa: Missouri Valley, altitude 1,022 feet; Jefferson, altitude 1,118 feet; Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet.

Nebraska: Crete, altitude 1,364 feet.

Colorado: Colorado Springs, altitude 5,978 feet; Fort Collins, altitude 4,984 feet; fields and roadsides.

P. crus-galli L.

Iowa: Jefferson, altitude 1,118 feet, abundant in fields, gardens, and along roads.

Colorado: Fort Collins, altitude 4,984 feet, along irrigation ditches or in moist places.

P. crus-galli muticum Vasey.

Colorado: Fort Morgan, altitude 4,500 feet, moist places and sandy bottoms of Platte River.

P. glabrum Gaudin.

Iowa: Missouri Valley, altitude 1,015 to 1,025 feet; Sioux City, altitude 1,110 to 1,125 feet, not common.

P. proliferum Lam.

Iowa: Missouri Valley, altitude 1,022 feet; Council Bluffs, altitude 990 to 1,025 feet; Carroll, altitude 1,240 feet.

Nebraska: Lincoln, altitude 1,159 feet, fields and roadsides.

P. sanguinale Linn.

Iowa: Jefferson, altitude 1,118 feet; Council Bluffs, altitude 990 to 1,025 feet; Sioux City, altitude 1,122 feet; Carroll, altitude 1,240 feet.

Nebraska: Lincoln, altitude 1,159 feet.

P. scribnerianum Nash.

Iowa: Council Bluffs, altitude 990 to 1,025 feet, common.

Nebraska: Crete, altitude 1,364 to 1,400 feet, prairies.

P. virgatum L.

Iowa: Carrol, altitude 1,240 feet; Sioux City, altitude 1,122 feet, abundant.

Nebraska: McCook, altitude 2,517 feet, flood plains of Republican River and prairies.

Chætochloa glauca (L.) Scribn.

Iowa: Jefferson, altitude 1,118 feet; Council Bluffs, altitude 990 feet; Sioux City, altitude 1,122 feet; Carroll, altitude 1,240 feet.

C. italica (L.) Scribn.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet; Jefferson, altitude 1,118 feet.

Nebraska: Crete, altitude 1,364 feet, an escape from cultivation and spontaneous along railroads.

C verticillata (L.) Scribn.

Iowa: Council Bluffs, altitude 1,025 feet, introduced.

C. viridis (L.) Scribn.

Iowa: Jefferson, altitude 1,118 feet; Council Bluffs, altitude 990 feet; Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet.

Nebraska: Crete, altitude 1,364 feet, a common weed.

Cenchrus tribuloides L.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,115 feet; Missouri Valley, altitude 1,015 to 1,028 feet; Council Bluffs, altitude 985 to 995 feet; abundant in Iowa along railroads where sand and gravel ballast are used, also in flood plains of streams.

Nebraska: McCook, altitude 2,517 feet, abundant; sandy flood plain of Republican River.

ORYZEÆ.

Homalocenchrus oryzoides (L.) Poll.

Iowa: Carroll, altitude 1,230 feet; Sioux City, altitude 1,115 feet; Jefferson, altitude 1,118 feet, abundant in low grounds.

H. virginicus (Willd.) Britt.

Iowa: Carroll, altitude 1,240 feet; Jefferson, altitude 1,118 feet; Sioux City, altitude 1,122 feet, frequent.

Nebraska: Crete, altitude 1,361 feet, in woods near streams.

PHALARIDEÆ.

Phalaris arundinacea L.

Iowa: Jefferson, altitude 1,118 feet; Sioux City, altitude 1,115 feet.

Colorado: Greeley, altitude 4,770 feet, low grounds along irrigation ditches.

Savastana odorata (L.) Scribn.

Colorado: Beaver Creek, Larimer County, altitude 8,500 feet.

AGROSTIDEÆ.

Aristida fasciculata Torr.

Nebraska: Lincoln, altitude 1,159 feet; McCook, altitude 2,517 feet; very common not only in flood plains of Republican River, near McCook, but on the adjacent hills.

Colorado: Denver, altitude 5,182 to 6,000 feet; Golden, altitude 5,691 to 6,000 feet; Mount Zion near Golden, altitude 7,500 feet; La Porte, altitude 5,000 feet; Fort Morgan. Abundant on the plains, as well as the sandy foothills near La Porte. At higher altitudes usually a short grass.

Stipa comata Trin. and Rupr.

Nebraska: McCook, altitude 2,507 feet.

Colorado: North Cheyenne Canyon near Colorado Springs, altitude 6,000 feet; Fort Collins, altitude 4,984 feet; Fort Morgan; La Porte, altitude 5 095 feet, dry soil, red sandstone.

Stipa pinnata neo-mexicana Thurb.

Colorado: La Porte, altitude 5,095 feet; rare in dry, red soil.

S. robusta Scribn.

Colorado: Long Gulch, Larimer County, altitude 7,800 feet; Bosworth Ranch, Larimer County, altitude 7,500 feet, abundant on flats in meadows; Beaver Creek, Larimer County, altitude 9,500 feet.

S. spartea Trin.

Iowa: Sioux City, altitude 1,122 feet; Jefferson, altitude 1,118 feet; Council Bluffs, altitude 990 to 1,000 feet; a common grass in Iowa; high, dry prairies and loess along the Missouri.

S. viridula Trin.

Nebraska: McCook, altitude 2,517 feet, flood plains of Republican River.

Colorado: Fort Collins, altitude 4,978 to 5,000 feet, high banks of irrigation ditches; Colorado Springs, altitude 5,978 feet.

Eriocoma cuspidata Nutt.

Colorado: Fort Morgan, Platte River, altitude 4,990 feet, sandy soil, second bottoms; east of Denver, sand hills, altitude 5,100 to 5,300 feet; La Porte, sand hills, red sandstone, altitude 5,095 feet.

Muhlenbergia gracilis Trin.

Colorado: Fort Collins, altitude 4,984 feet, dry prairies; Beaver Creek, Larimer County, altitude 9,500 to 10,000 feet, dry soil.

M. gracillima Torr.

Colorado: Colorado Springs, altitude 5,978 to 6,000 feet, grows in bunches, very dry soil.

M. mexicana Trin.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet; Missouri Valley, altitude 1,022 feet, along roadsides.

M. racemosa (Michx.) B. S. P.

Iowa: Missouri Valley, altitude 1,022 feet; Council Bluffs, altitude 1,000 feet; Jefferson, altitude 1,118 feet; Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet.

Nebraska: Crete, altitude 1,361 feet, moist prairies, abundant.

Phleum alpinum L.

Colorado: Happy Hollow, Larimer County, altitude 8,300 feet, low marshy grounds; Beaver Creek, Larimer County, altitude 9,000 to 10,000 feet, subalpine, in canyons and swamps, common.

P. pratense L.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet; Jefferson, altitude 1,118 feet; Missouri Valley; Logan.

Nebraska: McCook, altitude 2,517 feet, in moist grounds.

Colorado: Beaver Creek, Larimer County, altitude 9,100 feet, along trail, high grounds; trail above Beaver Creek, Larimer County, altitude 10,500 feet, with a strongly developed corm-like bulb. Timothy is common throughout the irrigated districts of northern Colorado.

Alopecurus geniculatus L.

Colorado: Long Gulch, Larimer County, bank of Little Beaver, altitude 8,500 feet, rooting in mud.

A. geniculatus fulvus (J. E. Smith) Scribn.

Colorado: South Branch Cache la Poudre River, Larimer County, altitude 7,975 feet, rooting in mud; Greeley, altitude 4,770 feet.

Sporobolus airoides Torr.

Colorado: Fort Collins, altitude 4,950 feet, near Cache la Poudre River; La Porte, Larimer County, altitude 5,095 feet, sandstone soil; Fort Morgan, altitude 4,500 feet.

S. asperifolius Thurb.

Colorado: La Porte, Larimer County, altitude 5,095 feet, red sandstone; Fort Morgan, altitude 4,500 feet, sandy second bottom of Platte River.

S brevifolius (Nutt.) Scribn.

Iowa: Missouri Valley, altitude 1,022 feet; Carroll, altitude 1,250 feet; Sioux City, altitude 1,122 to 1,130 feet; Missouri Valley, altitude 1,025 to 1,030 feet; Council Bluffs, altitude 1,020 to 1,040 feet.

Colorado: North Cheyenne Canyon, near Colorado Springs, near mouth of canyon, dry soil, altitude 6,000 feet.

S cryptandrus (Torr.) A. Gray.

Iowa: Missouri Valley, altitude 1,022 feet.

Nebraska: Crete, altitude 1,361 to 1,500 feet, dry hills; McCook, altitude 2,517 to 2,700 feet.

Colorado: Denver, plains, altitude 5,291 feet: Fort Morgan, altitude 4,500 feet.

S. depauperatus (Torr.) Scribn.

Colorado: La Porte, Larimer County, altitude 5,050 feet, sandy soil.

S. heterolepis A. Gray.

Iowa: Carroll, altitude 1,240 feet.

S. longifolius (Torr.) Wood.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet, prairies and loess.

Nebraska: Hastings, prairies.

S. vaginæflorus Vasey.

Iowa: Carroll, altitude 1,240 feet, roadsides, common; Sioux City, altitude 1,122 to 1,130 feet, common.

Agrostis alba L.

Iowa: Carroll, altitude 1,240 feet; Jefferson, altitude 1,118 feet; Logan, Council Bluffs, altitude 990 to 1,025 feet.

Nebraska: Crete, altitude 1,364 feet; McCook, altitude 2,517 feet, common in low grounds, along small streams, in pastures and meadows.

A. exarata Trin.

Colorado: La Porte, Larimer County; marsh near Cache la Poudre River, altitude 4,990 feet: Greeley, altitude 4,770 feet, irrigated flats; Beaver Creek, Larimer County, altitude 500 feet, in swamps.

A. scabra Willd.

Iowa: Sioux City, altitude 1,122 feet.

Colorado: Beaver Creek, Larimer County, altitude 9,100 feet, in woods of *Pinus murrayanus*, along trail.

Polypogon monspeliensis (L.) Desf.

Colorado: Fort Collins, altitude 4,954 feet, along irrigation ditches.

Calamagrostis canadensis (Michx.) Beauv.

Iowa: Jefferson, altitude 1,118 feet, low moist prairies and bottoms of small streams, common throughout western Iowa.

C. purpurascens R. Br.

Colorado: Beaver Creek, Larimer County, altitude 10,000 to 11,000 feet, in dry woods and open places; grows in large bunches.

Calamovilfa longifolia (Hook.) Scribn.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet.

Nebraska: McCook, altitude 2,517 feet, common loess bluffs along Missouri River.

AVENEÆ.

Deschampsia flexuosa (L.) Trin.

Colorado: North Cheyenne Canyon, near Colorado Springs, altitude 6,500 feet.

D. cæspitosa (L.) Beauv.

Colorado: Beaver Creek, Larimer County, altitude 9,800 to 11,000 feet, in low grounds and swamps; Long Gulch, altitude 7,775 feet.

Trisetum subspicatum Beauv.

Colorado: Mountain trail, Pikes Peak, altitude 11,720 feet; Beaver Creek, Larimer County, altitude 10,500 to 11,200 feet, abundant in woods and open places.

Avena fatua L.

Colorado: Fort Collins, altitude 4,978 to 5,000 feet; Denver, altitude 5,000 feet, weed in grain fields.

Danthonia intermedia Vasey.

Colorado: Beaver Creek, Larimer County, altitude 9,100 feet; Bosworth Ranch, altitude 7,500 feet, in open pine woods, abundant.

CHLORIDEÆ.

Spartina cynosuroides (L.) Willd.

Iowa: Carroll, altitude 1,230 feet; Sioux City, altitude 1,115 feet; Missouri Valley, altitude 1,015 feet, abundant, alluvial bottoms and sloughs.

Nebraska: McCook, marshes along Republican River, altitude 2,512 feet

S. gracilis Trin.

Nebraska: McCook, alkaline marshes of Republican River, altitude 2,512 feet.

Colorado: La Porte, Larimer County, marsh, altitude 5,100 feet.

Schedonnardus paniculatus (Nutt.) Trelease.

Nebraska: Lincoln, altitude 1,159 feet; Crete, altitude 1,364 feet, dry hills; Hastings, dry prairies; McCook, altitude 2,517 feet, second bench lands, flood plain Republican River and low hills.

Colorado: Greeley, altitude 4,779 feet, dry soil, plains.

Bouteloua curtipendula (Michx.) A. Gray.

Iowa: Carroll, altitude 1,240 feet: Sioux City, altitude 1,122 feet: Missouri Valley, altitude 1.022 feet; Logan, altitude 928 feet, high prairies and loess bluffs along the Missouri.

Nebraska: Crete, altitude 1,364 feet; McCook, altitude 2,517 feet.

B. oligostachya (Nutt.) Torr.

Nebraska: Lincoln, altitude 1.159 feet; Crete, altitude 1,364 feet; Hastings; Oxford, altitude 2,085 feet; McCook, altitude 2,517 feet, common, prairies, flood plain of the Republican River.

Colorado: Near Colorado Springs, altitude 5,978 feet; Denver, altitude 5,200 feet; Fort Collins, altitude 4,984 feet; Greeley, altitude 4,779 feet; Fort Morgan, altitude 4,500 feet; Stove Prairie, Larimer County, altitude 7,800 feet, not common.

Beckmannia erucaeformis (L.) Host.

Colorado: Fort Collins, altitude 4,980 feet; Greeley, altitude 4,770 feet.

Bulbilis dactyloides (Nutt.) Raf.

Nebraska: Lincoln, altitude 1,159 feet, local; Crete, altitude 1,364 feet, local; Hastings, abundant; McCook, altitude 2,517 feet, high hills and flood plains of Republican River.

Colorado: Fort Collins, altitude 4,984 feet, plains; Fort Morgan, altitude 4.500 feet, plains, and flood plain of Platte River.

FESTUCEÆ.

Munroa squarrosa (Nutt.) Torr.

Nebraska: McCook, altitude 2,517 feet, abundant, flood plain of Republican River.

Colorado: Denver, altitude 5,200 feet, high plains; Fort Morgan, altitude 4,500 feet, high plains; Golden, altitude 5,691 feet.

Phragmites vulgaris (Lam.) B. S. P.

Iowa: Sioux City, altitude 1,115 feet; Council Bluffs, altitude 990 feet, low grounds.

Nebraska: McCook, altitude 2,512 feet.

Colorado: Fort Collins, altitude 5,100 feet, marshes.

Redfieldia flexuosa (Thurb.) Vasey.

Colorado: Fort Morgan, altitude 4,500 feet, sandy bottoms of Platte River, common.

Eragrostis major Host.

Iowa: Jefferson, altitude 1,118 feet; Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet; Council Bluffs, altitude 990 to 1,000 feet, roadsides.

Nebraska: McCook, altitude 2,517 to 2,550 feet, roadsides.

E. pectinacea (Michx.) Steud.

Nebraska: Crete, altitude 1.361 feet; Lincoln, altitude 1,159 feet; McCook, altitude 2,517 feet.

E. purshii Schrad.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet; Council Bluffs, altitude 990 to 1,000 feet, common along roadsides.

E. hypnoides (Lam.) B. S. P.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,110 feet.

Eatonia obtusata (Michx.) A. Gray.

Iowa: Sioux City, altitude 1,122 feet.

Nebraska: McCook, altitude 2,517 to 2,550 feet, common, high prairies and in flood plain of Republican River.

Colorado: Fort Collins, altitude 4,984 feet.

E. pennsylvanica (D. C.) A. Gray.

Iowa: Jefferson, altitude 1,110 feet; Sioux City, altitude 1,122 feet; Council Bluffs, altitude 995 feet, low flood plain of rivers.

Kœleria cristata (L.) Pers.

Iowa: Jefferson, altitude 1,118 feet; Sioux City, altitude 1,122 feet; Logan, high prairies and loess bluffs along the Missouri.

Nebraska: McCook, altitude 2,517 feet.

Colorado: Foothills near Golden, altitude 7,500 feet; La Porte, altitude 5,095 feet, red sandstone hills; Long Gulch, Larimer County, altitude 7,775 feet, dry places, common.

Catabrosa aquatica (L.) Beauv.

Colorado: Fort Collins, altitude 4,984 feet, in seepage water from irrigation ditches; in gulch west of Fort Collins, altitude 5,500 feet, abundant in water.

Distichlis spicata (L.) Greene.

Nebraska: Lincoln, altitude 1,159 feet, salt marsh; McCook, altitude 2,517 feet, salt marsh, flood plain Republican River, base of hills.

Colorado: Denver, altitude 5,200 feet, in vacant lots.

Dactylis glomerata L.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet, common.

Nebraska: McCook, altitude 2,517 feet, not common.

Colorado: Golden, altitude 5,691 feet.

Poa arctica R. Br.

Colorado: Above Beaver Creek, Larimer County, at snow bank, altitude 10,000 feet; swamp, Beaver Creek Canyon, altitude 9,500 feet.

P. arida Vasey.

Nebraska: McCook, altitude 2,517 feet.

Colorado: Fort Collins, altitude 4,484 feet, in dry soil, plains; La Porte, altitude 5,500 feet; above Beaver Creek, Larimer County, altitude 10,000 feet, dry places.

P. buckleyana Nash.

Colorado: Beaver Creek, Larimer County, altitude, 9,100 feet; Golden; Mount Zion, altitude 7,500 to 8,000 feet; also in Clear Creek Canyon, altitude 7,500 feet, open grounds.

P. coloradoensis Vasey.

Colorado: Rists Canyon, altitude 6,500 feet.

P. compressa L.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet, dry banks along railroads.

Nebraska: Crete, altitude 1,364 feet, dry banks; McCook, altitude 2,517 feet.

Colorado: North Cheyenne Canyon, Colorado Springs, altitude 6,000 feet, in open grounds.

P. epilis Scribn.

Colorado: Above Beaver Creek, Larimer County, timber line, altitude 11,000 feet, also at snow bank, altitude 10,000 feet; and swamps, Beaver Creek Canyon, between 9,800 and 10,000 feet.

P. fendleriana Steud.
Colorado: Little Beaver, Larimer County, 9,100 feet; Beaver Creek Canyon, altitude 10,500 feet; south fork Cache la Poudre, Larimer County, altitude 8.500 feet.

P. flava L.
Colorado: Fort Collins, altitude 4,978 feet, low grounds near river; Greeley, altitude 4,779 feet, low grounds.

P. lucida Vasey.
Colorado: Golden, Clear Creek Canyon, altitude 7,500 feet.

P. lettermani Vasey.
Colorado: Pikes Peak, altitude 14,147 feet; timber line, altitude 11,700 to 13,600 feet, common and conspicuous among other grasses.

P. nemoralis L.
Colorado: Golden, Clear Creek Canyon; Mount Zion, altitude 6,500 to 7,500 feet; North Cheyenne Canyon, near Colorado Springs; mountain trail, Pikes Peak, altitude 11,000 feet; Fort Collins, altitude 4,950 feet, irrigated flats; in gulch west of Fort Collins, altitude 5,500 feet; above Beaver Creek, Larimer County, altitude 9,000 to 10,000 feet; Happy Hollow, Larimer County, altitude 7,900 feet; Rists Canyon, altitude 6,665 feet, common in the mountains in moist places.

P. pratensis L.
Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet.
Nebraska: Hastings; McCook, altitude 2,517 feet, in moist places.
Colorado: Colorado Springs, altitude 5,978 to 6,000 feet; Fort Collins, irrigated fields, altitude 4,978 feet; Bosworths Ranch, Larimer County, altitude 7,500 feet; Poverty Flats, Larimer County, altitude 7,800 feet, open, dry flats, grass much reduced in size; Happy Hollow, Larimer County, altitude 7,900 feet.

P. rupestris Vasey.
Colorado: Mountain trail, Pikes Peak, altitude 11,500 feet; above timber line, altitude 12,500 feet; above Beaver Creek, Larimer County, altitude 9,000 to 10,000 feet, in swamps.

P. tracyi Vasey.
Colorado: Fort Collins, gulch west of Pennock, altitude 5,500 feet, in lower places.

P. wheeleri Vasey.
Colorado: Beaver Creek, Larimer County, altitude 9,100 feet.

Puccinellia airoides (Nutt.) Wats. & Coult.
Colorado: Fort Collins, altitude 4,950 feet, near river; Greeley, altitude 4,770 feet, low grounds.

Panicularia nervata (Willd.) Kuntze.
Colorado: North Cheyenne Canyon, near Colorado Springs, altitude 8,000 feet, edges of brooks.

Festuca arizonica Vasey.
Colorado: Beaver Creek, Larimer County, altitude 9,100 to 9,500 feet, dry open places; Rists Canyon, altitude 6,500 feet, a stout harsh grass.

F. brevifolia R. Br.
Colorado: Beaver Creek, Larimer County, altitude 9,800 feet, dry sterile soil.

F. kingii (S. Wats.) Scribn.
Colorado: Little South Cache la Poudre, Larimer County, altitude 8,700 feet; Beaver Creek, Larimer County, altitude 9,500 feet.

F. ovina L.
Colorado: Mountain trail, Pikes Peak, altitude 11,000 feet (a form of); Beaver Creek, Larimer County, altitude 9,000 feet, dry soil; Happy Hollow, Larimer County, altitude 7,900 feet; Poverty Flats, Larimer County, altitude 8,020 feet.

F. octoflora Walt.

Iowa: Sioux City, altitude 1,122 feet.

Nebraska: Crete, altitude 1,364 feet; McCook, altitude 2,517 feet.

Colorado: Golden, altitude 5,691 feet; Mount Zion, near Golden, altitude 7,500 feet; Denver, altitude 5,294 feet, dry soil; common at all the above points.

Bromus breviaristatus Buckl.

Colorado: Fort Collins; gulch west of Pennock, Larimer County, altitude 5,500 feet, in moist soil.

B. ciliatus L.

Iowa: Sioux City, altitude 1,122 feet.

Colorado: Beaver Creek, Larimer County, altitude 9,100 to 9,800 feet, in rather dry woods.

B. ciliatus purgans A. Gray.

Colorado: Clear Creek Canyon, near Golden, altitude 7,000 feet, in spruce woods.

B. inermis Leyss.

Colorado: Fort Collins, altitude 4,974 feet, escaped from cultivation, College farm.

B. kalmii A. Gray.

Colorado: Stove Prairie, Larimer County, altitude 7,800 feet, dry open woods.

B. pumpellianus Scribn.

Colorado: Beaver Creek, Larimer County, altitude 9,500 feet.

B. tectorum L.

Colorado: Fort Collins, altitude 4,974 feet, escaped from cultivation, common station grounds, College farm.

B. unioloides HBK.

Colorado: Fort Collins, altitude 4,974 feet, escaped from cultivation, College farm.

HORDEÆ.

Agropyron dasystachyum subvillosum Scribn. and Smith.

Colorado: Bosworth ranch, Larimer County, altitude 7,500 feet, low meadows.

A. divergens Nees.

Colorado: Golden, altitude 5,691 feet, open low places; Clear Creek Canyon, altitude 6,500 to 7,000 feet; Beaver Creek, Larimer County, altitude 9,500 feet, swamp; Long Gulch, altitude 7,800 feet, low places.

A. divergens tenuispicum Scribn. and Smith.

Colorado: Happy Hollow, altitude 7,500 feet, low grounds.

A. pseudorepens Scribn. and Smith.

Colorado: Bosworth ranch, Larimer County, altitude 7,200 feet, in open woods.

A. repens (L.) Beauv.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet.

Nebraska: McCook, altitude 2,517 feet, introduced.

A. richardsoni Schrad.

Colorado: Stove Prairie, Larimer County, altitude 8,000 feet, in open, dry soil.

A. scribneri Vasey.

Colorado: Beaver Creek, Larimer County, at timber line, altitude 11,000 feet.

A. spicatum (Pursh) Scribn. and Smith.

Iowa: Sioux City, altitude 1,122 feet, loess soil, common.

Nebraska: Lincoln, altitude 1,159 feet; Crete, altitude 1,364 feet; Oxford, altitude 2,085 feet; McCook, altitude 2,517 feet; abundant, prairies.

Colorado: Fort Morgan, altitude 4,500 feet.

A. tenerum Vasey.

Colorado: Colorado Springs, altitude 5,978 feet; Fort Collins, altitude 4,970 feet, along irrigation ditches; Greeley, altitude 4,779 feet, along irrigation ditches.

Hordeum jubatum L.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,123 feet; Council Bluffs, altitude 990 to 1,000 feet; Logan, altitude 928 feet; Jefferson, altitude 1,100 feet; abundant weed in meadows, pastures along roadsides, and along railroads.

Nebraska: Hastings, along railroads; McCook, altitude 2,517 feet, along railroads, sandy bottoms of Republican River.

Colorado: Fort Morgan, altitude 4,500 feet; Fort Collins, altitude 4,978 feet; along railroads, seepage swamps, and flats, abundant.

H. pusillum Nutt.

Iowa: Council Bluffs, altitude 1,000 feet, introduced.

Nebraska: Crete, altitude 1,364 feet; Hastings, along railroads, dry prairie soil; McCook, altitude 2,517 feet, along railroads and prairies.

Colorado: Denver, altitude 5,294 feet, prairies; Fort Collins, altitude 4,978 feet.

Elymus canadensis L.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet, loess bluffs; Jefferson, altitude 1,118 feet; Logan.

Nebraska: Lincoln, altitude 1,159 feet; Crete, altitude 1,364 feet, dry prairies, along railroads; McCook, altitude 2,517 feet, flood plains of Republican River.

Colorado: Fort Collins, altitude 4,984 feet, along railroads; Colorado Springs, altitude 5,978 feet; Rists Canyon, Larimer County, altitude 6,500 feet, dry open places.

E. glaucus Buckley.

Nebraska: McCook, altitude 2,517 feet, dry places, flood plains Republican River.

E. macounii Vasey.

Colorado: Greeley, altitude 4,770 feet, river bottoms; Fort Collins, altitude 4,900 feet, flats, Cache la Poudre River, common. The species has also been found near Jewell Junction, Iowa (Carver), in what was once an old lake bed.

E. nitidus Vasey.

Colorado: Near Golden, Clear Creek Canyon, altitude 6,000 to 7,000 feet, in yellow pine woods.

E. robustus Scribn. and Smith.

Iowa: Carroll, altitude 1,240 feet.

E. striatus Willd.

Iowa: Carroll, altitude 1,240 feet; Sioux City, altitude 1,122 feet; Jefferson, altitude 1,118 feet; Council Bluffs, altitude 990 feet.

E. triticoides Buckl.

Colorado: Near Golden, Clear Creek Canyon, altitude 7,500 feet, in woods.

E. virginicus L.

Iowa: Jefferson, altitude 1,118 feet; Sioux City, altitude 1,122 feet; Council Bluffs, altitude 990 feet; Logan, altitude 928 feet; Missouri Valley, altitude 1,022 feet.

Sitanion elymoides Raf.

Nebraska: McCook, altitude 2,517 feet, abundant, flood plains Republican River.

Colorado: Denver, altitude 5,294 feet, abundant, dry plains; Golden, altitude 7,000 feet; Mount Zion, near Golden, altitude 7,500 feet; Colorado Springs, altitude 5,978 feet; North Cheyenne Canyon, near Colorado Springs, altitude 6,500 feet; Fort Morgan, altitude 4,500 feet.

INDEX.

Page.

- Agropyron caninum 18
  - dasystachyum subvillosum 43
  - divergens 18, 43
    - tenuispicum 43
  - pseudorepens 43
  - repens 23, 43
  - richardsoni 18, 43
  - scribneri 43
  - spicatum 22. 43
  - tenerum 32
- Agrostideæ 37
- Agrostis alba 30, 39
  - exarata 39
  - scabra 39
- Alfalfa 16
- Alopecurus geniculatus 38
  - fulvus 38
  - pratensis 8
- Alsike 17
- Andropogon hallii 34
  - nutans avenaceus 22, 36
  - provincialis 18
    - furcatus 36
  - scoparius 27, 36
- Andropogoneæ 36
- Arrhenatherum elatius 33
- Aristida fasciculata 34, 37
- Astragalus canadensis 9
  - caryocarpus 21
- Avena fatua 39
- Aveneæ 39
- Barnyard grass 17
- Bearded Wheat-grass 18
- Beckmannia erucaeformis 40
- Big Blue-stem 18
  - Sand-grass 19
- Black Grama 19
- Blue Grama 19
- Blue-joint 20
- Bouteloua curtipendula 31, 40
  - hirsuta 19
  - oligostachya 19, 40
- Bromus breviaristatus 31, 43
  - ciliatus 32, 43
    - purgans 43
  - inermis 10, 13, 25, 43
  - kalmii 43
  - pumpellianus 34. 43
  - tectorum 13, 43
  - unioloides 13, 43
- Broom-corn millet 20
- Buffalo Bunch-grass 20
  - Grass 20
  - Pea 21

Page.

- Bulbilis dactyloides 20, 40
- Bunch grass 21
  - Spear-grass 21
- Bushy Blue stem 22
- Calamagrostis canadensis 20. 39
  - purpurascens 39
- Calamovilfa longifolia 19, 39
- California Oat-grass 22
- Carex ajuncis 13
  - marcida 13
- Catabrosa aquatica 13, 41
- Cenchrus tribuloides 37
- Chaetochloa glauca 24, 36
  - italica 36
    - germanica 28
  - verticillata 36
  - viridis 24, 37
- Chlorideæ 40
- Colorado Blue-stem 22
- Cord-grass 23
- Couch-grass 23
- Crab-grass 23
- Crotalaria sagittalis 9
- Dactylis glomerata 29, 41
- Dalea alopecuroides 9
- Danthonia californica 22
  - intermedia 39
- Deschampsia cæspitosa 39
  - flexuosa 39
- Distichlis spicata 41
- Downy Oat-grass 23
- Early Bunch-grass 23
- Eatonia obtusata 23, 41
  - pennsylvanica 41
- Elymus canadensis 35, 44
  - condensatus 24
  - glaucus 44
  - macounii 13, 44
  - nitidus 44
  - robustus 44
  - striatus 44
  - triticoides 44
  - virginicus 44
- Eragrostis hypnoides 41
  - major 40
  - pectinacea 40
  - purshii 41
- Eriocoma cuspidata 38
- Euphorbia marginata 10
- Feather Bunch-grass 23
- Festuca arizonica 42
  - brevifolia 42
  - kingii 42
  - octoflora 32, 43

Page.

- Festuca ovina 31, 42
  - scabrella 20
- Festuceæ 40
- Fowl Meadow-grass 24
- Foxtail 24
- Giant Rye-grass 24
- Homalocenchrus oryzoides 37
  - virginicus 37
- Hordeæ 43
- Hordeum jubatum 32, 44
  - pusillum 44
- Hosackia purshiana 35
- Hungarian brome 25
- Jamesia americana 14
- Kentucky Blue-grass 25
- Koeleria cristata 29, 41
- Large Rush-grass 27
- Lepidium apetalum 26
- Little Blue-stem 27
- Loco weed 27
- Lupinus plattensis 27
- Manna-grass 27
- Meadow Foxtail 8
  - Grass 27
- Medicago sativa 16
- Millet 28
- Muhlenbergia 8
  - arizonica 38
  - gracilis 38
  - gracillima 38
  - mexicana 38
- Munroa squarrosa 40
- Needle-grass 28
- Orchard grass 29
- Oryzeæ 37
- Oxytropis lambertii 9, 27
- Paniceæ 36
- Panicularia aquatica 27
  - nervata 27, 42
- Panicum capillare 36
  - crus-galli 17, 36
    - muticum 36
  - glabrum 36
  - miliaceum 20
  - proliferum 36
  - sanguinale 23, 36
  - scribnerianum 36
  - virgatum 33, 36
- Pepper-grass 26
- Petalostemon candidus 9
  - violaceus 9
- Phacidium medicaginis 17
- Phalarideæ 37
- Phalaris arundinacea 30, 37
- Phleum alpinum 38
  - pratense 33, 38
- Phragmites vulgaris 30
- Physocarpus torreyi 14
- Pigeon-grass 24
- Pinus ponderosus 14
  - scopulorum 14
- Poa alpina 28
  - arctica 41
  - arida 21, 41
  - buckleyana 28, 41

Page.

- Poa coloradoensis 41
  - compressa 35, 41
  - epilis 41
  - fendleriana 42
  - flava 24, 42
  - lettermani 42
  - lucida 42
  - nemoralis 28, 42
  - pratensis 25, 42
  - rupestris 42
  - traceyi 42
  - wheeleri 28, 42
  - wolfii 28
- Polypogon monspeliensis 13, 39
- Populus tremuloides 14
- Porcupine-grass 29
- Prairie June-grass 29
- Puccinellia airoides 42
- Purshia tridentata 14
- Redfieldia flexuosa 40
- Red-top 30
- Reed Canary-grass 30
- Reed-grass 30
- Rubus deliciosus 14
- Rye 30
- Satin-grass 8
- Savastana odorata 37
- Schedonnardus paniculatus 33, 40
- Scirpus lacustris 13
- Secale cereale 30
- Sheep's Fescue 31
- Short-awned Brome 31
- Side Oats Grama 31
- Sitanion elymoides 44
- Sleepy grass 31
- Slender Fescue 32
  - Wheat-grass 32
- Smooth Brome 25
- Solidago canadensis 10
  - rigida 10
- Spartina cynosuroides 23, 40
  - gracilis 40
- Sporobolus airoides 38
  - asperifolius 38
  - brevifolius 38
  - condensatus 27
  - cryptandrus 27, 38
  - depauperatus 39
  - heterolepis 21, 39
  - hookeri 27
  - vaginæflorus 27, 39
- Squirrel-tail grass 32
- Stipa comata 28, 37
  - pennata neo-mexicana 37
  - robusta 31, 37
  - spartea 29, 37
  - viridula 23, 31, 37
- Swamp Chess 32
- Switch-grass 33
- Tall Grama 31
  - Oat-grass 33
- Texas Crab-grass 33
- Timothy 33
- Trifolium dasyphyllum 15
  - hybridum 17

Page.

- Trifolium nanum 15
  - parryi 15
  - pratense 30
  - repens 34
  - stoloniferum 9
- Triple-awned Beard-grass 34
- Trisetum subspicatum 23, 39

Page.

- Turkey-foot grass 34
- Western Brome-grass 34
- White Clover 30, 34
- Wild Rye 35
  - Vetch 35
- Wire Bunch-grass 18
  - grass 35

BULLETIN NO. 10. Agros. 27.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

LIBRARY,
NEW YORK
BOTANICAL
GARDEN.

A REPORT

UPON THE

GRASSES AND FORAGE PLANTS

OF

CENTRAL TEXAS.

BY

H. L. BENTLEY,

Special Agent in Charge of Grass Experiments at Abilene, Tex.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

BULLETIN No. 10. Agros. 27.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

A REPORT

UPON THE

GRASSES AND FORAGE PLANTS

OF

CENTRAL TEXAS.

BY

H. L. BENTLEY,

Special Agent in Charge of Grass Experiments at Abilene, Tex.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Agrostology,
Washington, D. C., March 3, 1898.

Sir: I have the honor to transmit herewith for publication, as Bulletin No. 10 of this division, a report by Mr. H. L. Bentley, special agent in the Division, upon the grasses and forage plants of central Texas. This report contains brief accounts of the physical character of central Texas; the early and present condition of the ranges; and popular descriptions, and general observations upon the distribution and economic importance of a large number of the grasses and forage plants native to the region. From this report stockmen and others will gain some idea of the extent and value of the natural forage resources of the country, and it will, without doubt, awaken an interest in the preservation and improvement of the forage supplies.

Respectfully,

F. Lamson-Scribner,
Agrostologist.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

	Page.
The cattle ranges and their deterioration	7
Purpose of report	7
Physical character of the country	7
Early condition of the ranges	8
Speculation and overstocking	9
How the stock ranges may be renewed	10
Need of hay and other forage	10
Native grasses and forage plants recommended for propagation	11
Grasses	11
Forage plants not grasses	20
Grasses and forage plants of probable value	25
Common grasses of little forage value	28

ILLUSTRATIONS.

Page.

Fig. 1. Feather Blue-stem (*Andropogon saccharoides torreyanus*)........ 12
2. Blue Grama (*Bouteloua oligostachya*)........ 13
3. Everlasting Grass (*Eriochloa punctata*)........ 14
4. Curly Mesquite (*Hilaria cenchroides*)........ 15
5. Barnyard Grass (*Panicum crus-galli*)........ 17
6. Colorado Grass (*Panicum texanum*)........ 18
7. Wild Bean (*Phaseolus helvolus*)........ 22
8. Buffalo Grass (*Bulbilis dactyloides*)........ 24
9. Knot Grass (*Paspalum distichum*)........ 27
10. Tumble Weed (*Amaranthus blitoides*)........ 30
11. Ground Plum (*Astragalus crassicarpus*)........ 31
12. Alfilaria (*Erodium cicutarium*)........ 33
13. Prickly Pear (*Opuntia engelmanni*)........ 35
14. Mesquite Bean (*Prosopis juliflora*)........ 36

A REPORT UPON THE GRASSES AND FORAGE PLANTS OF CENTRAL TEXAS.

THE CATTLE RANGES AND THEIR DETERIORATION.

PURPOSE OF REPORT.

The purpose of this report is to invite the attention of stockmen and farmers to the mistakes made in the past in dealing with native grasses and forage plants, and to offer suggestions for their future guidance.

Central Texas may be considered a typical stock section. The problems here presented are identical with those of other regions where overstocking and insufficient care of the natural growth of grasses and forage plants have led to the impoverishment of the ranges. The natural herbage of the Southwestern plains and prairies was once as varied and as rich as could be found anywhere. The wild grasses could not be excelled either for hay or pasturage. They are still to be found scattered over the region, not in as great profusion and abundance as in the days when the cattlemen first drove their herds into that magnificent pasture, but enough of them are there to make it possible by intelligent management to produce something like the former conditions.

PHYSICAL CHARACTER OF THE COUNTRY.

The central Texas of this report includes all the counties of Stonewall, Haskell, Throckmorton, Fisher, Jones, Shackelford, Nolan, Taylor, Callahan, Runnels, Coleman, Tom Green, Concho, McCulloch, and parts of the counties of Kent, Scurry, Mitchell, Coke, San Saba, Brown, Eastland, Stephens, and Young. It embraces a territory about 100 miles wide, east and west, and about 200 miles long, north and south.

The characteristics common to these counties are: An open prairie country with some black-jack, post-oak, and live-oak timber on the uplands and ridges; a scattering growth of mesquite on the lands away from the streams, which, together with the timber on the streams, supplies ample firewood and posts for fencing purposes; numerous streams that furnish an abundance of water, fringed along their banks with groves of pecan, elm, hackberry, wild china, cottonwood, and other trees; an altitude ranging from 1,500 to 1,900 feet above sea level; an annual rainfall of from 20 to 31 inches, the average being about 27 inches, so distributed through the year that it means sufficient for range purposes, but periodically not sufficient for the best results in farming; a range of temperature from 90° to 102° down to 7° F.; a rich alluvial soil in most of the valleys, while on the uplands there are loams, generally containing a large admixture of calcareous marls. The soils vary in color from a light gray or yellow, through all the intermediate colors—chocolate, mulatto, red, and brown—to black, all productive and susceptible of high cultivation, and especially rich in the elements necessary for the production of the cereals and grasses. There is a great variety of native forage plants and grasses, comprising species that appear in succession from February to November.

In Stonewall, Nolan, Mitchell, McCulloch, Coke, San Saba, and Taylor counties the topography presents a greater diversity than in the others. In Taylor County there are considerable elevations, a mountain range extending through it from southeast to northwest, the highest point being 519 feet above the surrounding plains. In Throckmorton, Stephens, Shackelford, Callahan, Runnels, Coleman, and Tom Green counties there are broken areas. In the other ten counties, where there are neither mountains nor hills, the general surface is gently undulating.

Under the direction of the Agrostologist of the United States Department of Agriculture, portions of this section were visited by the writer during August, September, and October (1897), and collections of grasses made, notes being taken relative to the forage plants, native and domesticated, that have given promise of future value. These observations, owing to the limited time in which they were made, do not cover all the counties named, but it is probable that nearly every grass noted may be found in each of the counties, and the statements regarding them will doubtless apply to the entire region.

EARLY CONDITION OF THE RANGES.

The natural meadows of this section when the first cattlemen took possession were excellent. It was an ideal pasture land. The streams were full the year round, and the absence of heavy dews or long-continued wet spells in autumn caused the abundant growth of grasses to ripen and cure on their own roots into hay of the best quality, available through all the winter months. There was shelter from storms in the timber along the streams. The prairie dogs and jack rabbits were kept in check by their natural enemies. The rapid spread of weedy shrubs and cactus was prevented by the annual fires that swept the country.

No attempt at systematic settlement was made until the building of the Texas and Pacific Railroad in 1883. Before that time there was no one to assert any special claim to any particular lands. True, nearly all belonged to private individuals, railroad companies, counties, or to some of the State trust funds, but none of the legal owners were on the ground in person. There was nothing to prevent the cowmen from appropriating the range, arbitrarily laying off their range boundaries, and claiming them under their so-called "range rights." The first cowman who entered a given section established his headquarters in some favored spot and claimed, under his range rights, everything in sight. When the next cowman moved in, the two together divided the range and each kept his herd on his own side of the boundary line agreed upon between them. As others came, the range was further subdivided until it was all fully occupied. Absolute good faith was maintained, each recognizing the range rights of the other. There was no need for one to crowd the other, for there was plenty, and to spare, for all. They each and all recognized that with "free grass" the road to wealth was an easy and certain one.

SPECULATION AND OVERSTOCKING.

With the entrance of the railroad into this pastoral region the owners of the lands under consideration, or their agents, began to appear with a view to looking up their properties. Then it was that the cowmen began to realize that they could not longer depend on free grass. The result was natural, indeed inevitable. Every man was seized with a desire to make the most of his opportunities while they lasted. Whereas there had previously been no rent to pay and only a minimum of taxes, each one saw that this situation could not last. In consequence every man who had a "range right" went into the market to buy cows to eat as much of the grass as possible before he should be dispossessed of his free holding. Soon there were more buyers than sellers. Prices went up and a fever of speculation ensued. Range rights, herds of cattle, and flocks of sheep changed hands at fabulous prices. Men of every rank were eager to go into the "cow business." In a short time every acre of free grass was stocked beyond its fullest capacity. Thousands of cattle or sheep were crowded on the ranges where half the number was too many. The grasses were entirely consumed; their very roots were trampled into dust and destroyed. In their eagerness to get something for nothing speculators did not hesitate at the permanent injury, if not total ruin, of the finest grazing country in America.

From that day to the present but little intelligent effort has been made to improve the pastures and again cover them with the rich vegetation which the soil is capable of supporting. It is not yet too late to remedy the evil, but no time is to be lost. There is need in the first place of the enactment of more beneficent lease laws to govern the use of county and State lands. Permanency of tenure is essential, for it is only through such a condition that stockmen can be made to see that it is to their own interest to improve the carrying capacity of the range. There must be intelligent and concerted effort, and it can not be expected that stockmen will be different from other men if they decline to make such effort at range improvement when the results of their toil and forethought are to be enjoyed by others. They are all alike, grass destroyers, so long as it is not to their own immediate interest to be grass preservers. Stockmen have been reckless in this direction, farmers have been their allies. The latter still wage a war of extermination on the grasses growing in and about their fields. In his effort to make room for more cheap cotton the farmer ruthlessly breaks the sod that if properly treated and cared for as pasture would yield him far better returns.

HOW THE STOCK RANGES MAY BE RENEWED.

In considering the question of how the ranges may be renewed, the ideas and opinions of the leading stockmen of this section have been solicited. They vary from that of giving the grasses absolute rest until the ground has been reseeded with the best native varieties, to that of partially breaking the sod and seeding down the land to sorghum, Johnson grass, or the best of the tame hay grasses.

If the natural pastures are to be once more brought up to their original condition certain precautions must be taken. There must be no more overstocking of the range. On the contrary, as far as practicable, the land must be systematically rested. Some of the leading stockmen are now dividing up their holdings into several pastures, one being held exclusively for winter use, another for spring, another for midsummer or autumn. This practice will, in the case of the winter pasture, enable the early grasses to ripen and shed their seeds. To be successful there should be rotation in the seasonal use of these pastures. Thus a pasture which is grazed closely during winter for three or four successive years should then be grazed only in summer for a like term, in order that the late-maturing grasses, which would naturally be the ones eaten during the winter, may have an opportunity to reseed themselves and regain their former abundance. By this system of rotation the carrying capacity of the pastures may be doubled or trebled in the course of a few years.

NEED OF HAY AND OTHER FORAGE.

It will be necessary also to provide hay and forage, which may be used during storms or in case of unusually severe winters, or in years when through drought or other causes the natural herbage is less than the normal. The range grasses, even when abundant, may be so injured by such unusual occurrences as heavy autumn rains as to be worthless as food for stock. During the severe winters thousands of cattle and sheep often die from starvation. Five per cent of their value invested in hay or other feed and kept available for use during winter storms would not only have saved their lives, but have brought them through the season in growing and healthy condition. Vast quantities of hay could a few years ago be secured anywhere for the cost of cutting and curing. With a renewed range this condition may be again attained, and even if the wild hay can not be depended on or can not be secured a sufficient crop of sorghum, Kaffir corn, or some of the coarser cultivated hay grasses should be planted to supply feed in times of scarcity.

Hay meadows formed of native grasses are greatly needed. These native grasses have in the past shown all the best qualities of hay grasses elsewhere, and they do not require any experimental work to determine their adaptability to soil and climate or their general value. More than a third of all the grasses in the United States grow within the confines of the state of Texas, and the establishment of natural hay meadows of the wild grasses and forage plants is bound to prove successful and profitable. The first question to be determined is, which are the best for hay and which for grazing. Stockmen can do this work on their own ranches and settle the question for themselves. They can prepare and seed down lands with the best grasses and save hay every year for winter use, thereby adding largely to the capacity of their pastures for carrying stock. As soon as dependence is placed on hay or fodder the pastures are bound to improve, because stock fed a part of every year will need less pasture grass, and the pastures being allowed this periodic rest will more rapidly attain their best development.

NATIVE GRASSES AND FORAGE PLANTS RECOMMENDED FOR PROPAGATION.

In a consideration of the different native grasses and forage plants it has not been possible to inspect the ranges in all the counties, but those here discussed may be taken to fairly represent the entire section. Of the many varieties found, the following, from personal observation and from the accounts given by ranchmen and farmers, appear to be the most valuable:

GRASSES.

Western Wheat-grass (*Agropyron spicatum*) is a blue-stem which is rather wiry. It is from 20 to 30 inches high, and grows luxuriantly all over central Texas. While it will not produce as much hay to the acre as some other species, stockmen value it highly for its nutritive qualities. It withstands the droughts to which the section is periodically subject, and is to be found not only on the uplands, but also in the low moist meadows. It is also known in the Northwest as Colorado Blue stem.

Feather Sedge or **Feather Blue-stem** (*Andropogon saccharoides torreyanus*) (fig. 1) grows in all of the counties of central Texas. It has a feathery looking "seed head" and a blue stem, grows from 2 to 3½ feet tall, and ripens an abundance of seed in September. When cured it is soft to the touch and is much relished by cattle. This is a common grass on the dry prairies and mesas from Kansas to Texas westward to Arizona and southward into Mexico.

Bushy Blue-stem (*Andropogon nutans*), a very tall, cane-like grass, growing principally in rocky places, though it is also on the open prairies. It will produce good hay in large quantities.

Side-oats Grama (*Bouteloua curtipendula*), one of the best native grasses in central Texas, is highly regarded by stockmen. It was splendidly seeded in September when examined on the range. It grows equally well on the uplands and lowlands, in fallow ground and in the pastures. Cattle are very fond of it both before and after it ripens seed. It produces a great many seeds that do not shatter out readily, and, as it grows from 18 inches to 3 feet tall and makes a large quantity of fodder, soft when cured, it is an excellent hay grass. It is common throughout the prairie region and on the plains extending eastward to Pennsylvania.

Black Grama (*Bouteloua hirsuta*).—Black grama is not as common throughout central Texas as stockmen would like to have it. It is not a hay grass, as it does not often grow tall enough for the mower, but it is certainly one of the best grasses for grazing purposes. In appearance it closely resembles the blue grama (*Bouteloua oligostachya*), which is one of the most common of the native grasses of the "benches" of Montana. Several stockmen of Mitchell and Taylor counties state that this black grama is "taking the prairie" rapidly, more of it being seen in 1897 than in former years.

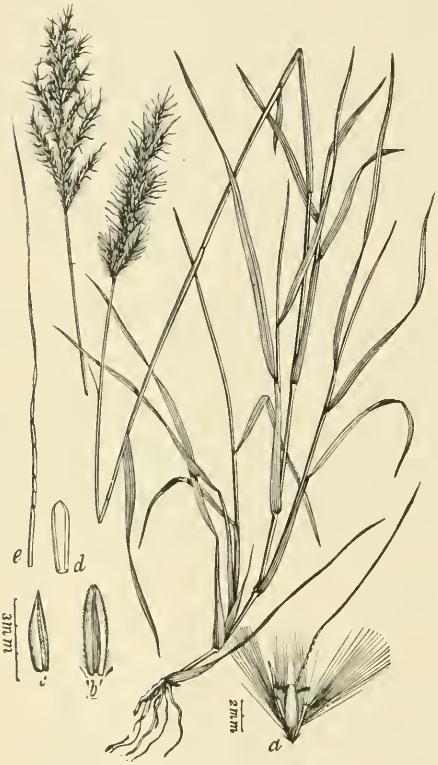


Fig. 1.—Feather Blue-stem.

Blue Grama (*Bouteloua oligostachya*) (fig. 2).—Very similar in most respects to the black grama, about the only difference noticeable by the unscientific observer being the lighter color of its "seed heads." It grows throughout all the cattle-raising States west of the Mississippi and is very common in Montana and Colorado, where it is known as Buffalo-grass. In central Texas it is regarded with much favor by stockmen. As it grows well on the high arid plains and bench lands and also on the lower and damper pasture lands, and is both a hay and a pasture grass, too high an estimate can not be put on it for stock purposes. It is said that "it far exceeds, in general opinion, the true buffalo grass (*Bulbilis dactyloides*), which has gained much of its credit at the expense of *Bouteloua*, the two being often confused by farmers and ranchmen."

Rescue Grass or Arctic Grass (*Bromus unioloides*).—An excellent winter-pasture grass, but not widely distributed in this section. The specimen forwarded for identification was found in Nolan County, in September. At that time its seeds had shattered out badly, and its leaves were not green, nor was there much of it. Stockmen say, however, that earlier in the season it was to be found in fair quantities in Mitchell, Nolan, and Taylor counties. It has been reported from some of the other counties of central Texas, where it is valued both as a pasture and as a hay grass.

Arizona Millet (*Chætochloa macrostachya*).—A tall, rather coarse upland grass. It is a valuable hay grass because of its habit of growth, producing an abundance of fodder and seed. It is one of the most common grasses of this section of Texas.

Bermuda (*Cynodon dactylon*).—Probably not a native, but now so common in every part of this section that it is regarded as one of its distinctive grasses. It grows about the windmills where it is freely watered tall enough to be cut for hay. For grazing purposes it is doubtful if any other grass will furnish more or better pasturage. If stockmen, instead of confining the propagation of it to their yards and lawns, would put down extensive fields of it, they would be amply repaid for the labor and expense. One stockman who has a 10-acre pasture well sodded with Bermuda grass says that he kept more than a dozen calves and 4 head of horses on it month after month, and that he frequently permitted as many as 10 extra horses to run on it several days in succession, and that he never thought he had overstocked it. In the cities of central Texas it is being used to improve the footpaths and lawns. Stockmen and farmers in the country are

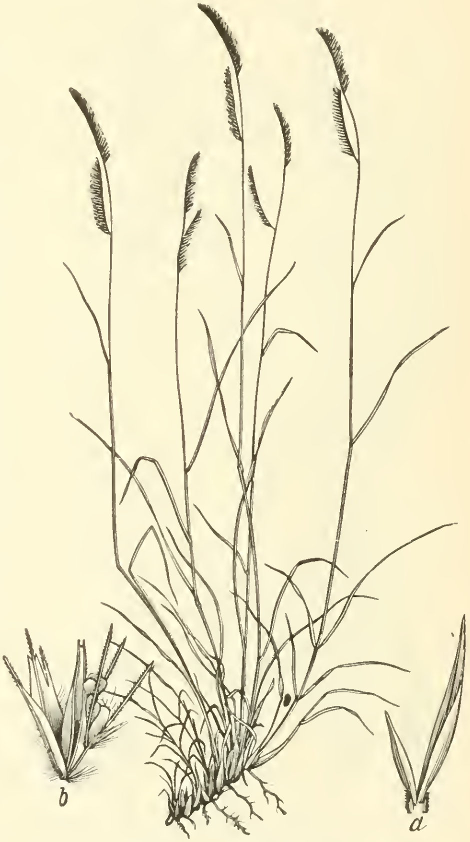


Fig. 2.—Blue Grama.

using it to advantage to strengthen their dams and the banks of their water tanks.

Wild Rye (*Elymus canadensis*) grows in nearly every neighborhood. It is to be found occasionally on the uplands, but is more common in the valleys. Stockmen say that, when it is young and green, stock of all kinds is fond of it. They think it will make good hay. It is one of the most promising of the native hay grasses.

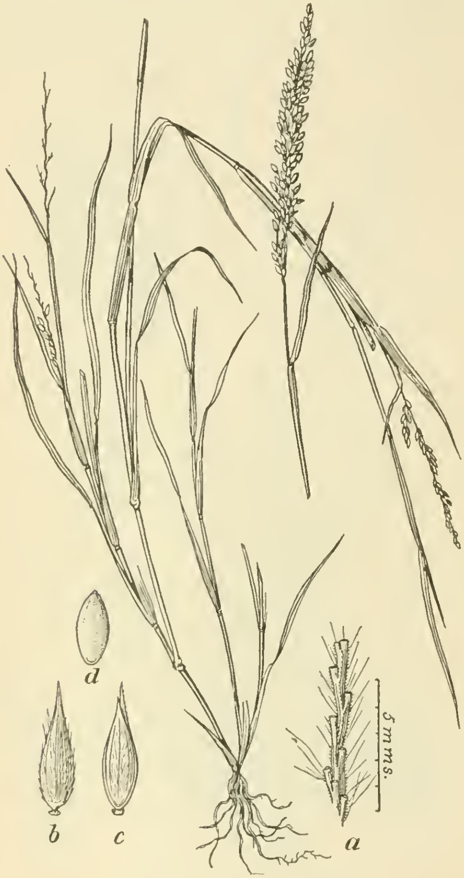


FIG. 3.—Everlasting Grass.

Everlasting Grass (*Eriochloa punctata*) (fig. 3).—This grass was found in Shackelford County in a stubble field, where stock were eating it greedily. This was in September, but a month later it was found in several other localities on the benches and in the valleys. A well-informed stockman of Taylor County says that it is a good pasture grass when it first greens out in the spring, affords good pasturage all through the summer months, and in autumn, when protected from stock, will furnish in abundance a good quality of hay. In the times when Fort Griffin, in Shackelford County, was occupied as a United States Government post, this grass was a main reliance of the troops for hay. At that time it grew all over that vicinity from 2 to 4 feet high, and, as large sections were covered with it to the practical exclusion of other grasses, it was not difficult to secure hay in large quantities. Now, however, it is rarely to be found in quantities sufficient or under conditions suitable for hay purposes—another instance of the reckless manner in which the range in all central Texas has been abused. In the valley of the Clear Fork, a few miles below Fort Griffin, this grass was seen growing luxuriantly in a field where no stock was allowed, showing by its strong growth what it will do under favorable conditions. Farmers and stockmen should cultivate it with special reference to its high value as a hay grass.

Curly Mesquite (*Hilaria cenchroides*) (fig. 4).—Too much can not be said in praise of this superior pasture grass. Fortunately for stockmen, it is found in all the counties of central Texas and is about the most abundant, as it certainly is one of the most valuable, of all the native grasses. It has a peculiar habit of creeping over the ground and rooting at the joints of the stems, from which spring leafy branches that in their turn reach out for other places in which to take root. In protected localities it greens out very early in the spring, makes a thick mat of leafy turf during the summer, matures on its roots, and in the fall and winter, when not rotted by late rains, affords excellent pasturage for all classes of stock. No grass stands the long dry spells to which the section is periodically subject better than the curly mesquite. As it does not grow tall, sheep, horses, and even hogs are especially fond of it, and cattle prefer it to almost any other grass. In very dry weather it dries up and appears to be dead, but in a few hours after a warm rain it becomes green to the end of its smallest leaf blade and stem. When matured on its roots, it is very much better feed than at any other time, and stock will not only live but fatten on it without grain. It is doubtful if acre for acre it will support as many head of stock, year in and year out, as Bermuda grass, but it will stand drought better, and for general range purposes is certainly superior. When lands are sodded down to it and it is given the advantage of irrigation even by sprinkling, as is done in the case of Bermuda, it makes as attractive looking turf as the latter, especially when closely cut by the lawn mower. Some of the central Texas stockmen are sodding down small pastures, from 5 to 20 acres, with it, to be used as calf lots and for pasturing the ranch horses used about headquarters. They report that such pastures in a good year will support one head of stock per acre. It grows well on any but alkali soils, on uplands and lowlands, out in the open or in the shade. In Jones County there is a small pasture well sodded within which

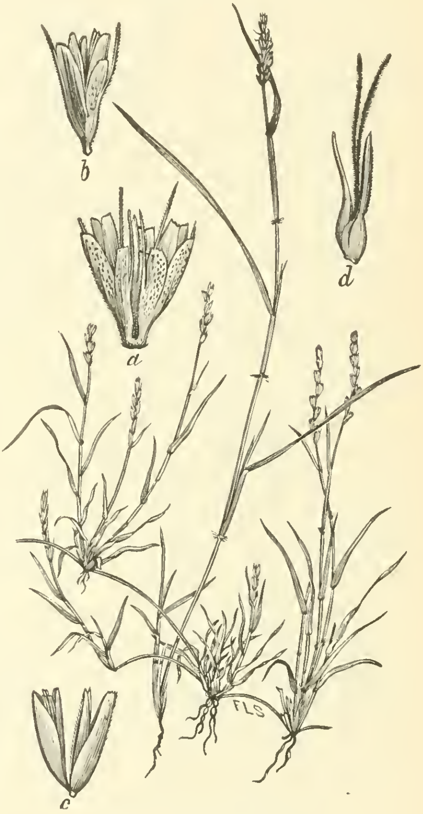


Fig. 4.—Curly Mesquite.

mesquite trees of unusually large growth stand so close together that a wagon can with great difficulty be taken through. In this pasture the curly mesquite grows in the early summer quite tall enough to be cut with a mowing machine. Under very favorable conditions it could perhaps be developed into a good hay grass, but it is primarily and pre-eminently a pasture grass. A Callahan County stockman, finding that there were many naked spots in his pasture, took the roots of the curly mesquite and with an ordinary garden hoe put them in the ground, scattering them over such spots from 3 to 4 feet apart. This was in the early spring. By the following autumn they had rooted and sent out their creeping stems to take root, and had covered the bare places. This was a case of making two blades of grass grow where none grew before, and suggests a practical way for the renewal of all the much-abused pastures in and out of central Texas. On plowed land this grass will spread very rapidly, soon forming a fine turf. It will pay farmers and stockmen to make the experiment of growing it on plowed land.

Wild Timothy (*Muhlenbergia racemosa*).—Of all the native hay grasses of central Texas, this is one of the most valuable. It does not occur except in moist soils, but there it grows luxuriantly. A specimen collected near Abilene measured 4 feet 7 inches in height, and it is often seen over 5 feet tall. It is slender and erect, its stems soft even when cured, with an abundance of leafage that does not fall from the stems, many seeds that do not drop readily, and short but numerous creeping root-stalks. A farmer on whose place a lot of this was growing informed me that the only grass of the many varieties growing together on the place preferred by his cattle over this wild timothy was the wild oats (*Uniola latifolia*). An acre of good moist land seeded down to wild timothy ought to produce in a fair season 2 to 2½ tons of hay equal to the best grown in any country.

White Top (*Triodia albescens*) is another excellent hay grass. It has a very soft stem with an abundance of leaves, and in September was splendidly seeded. It is found principally in the lowlands, where it grows from 18 to 20 inches tall; and also on the uplands, even in sandy and rocky places. In Taylor County, near Lytle Lake, it grows luxuriantly, but only there in places where it has the benefit of subirrigation. It will doubtless prove a valuable grass for hay purposes when in cultivation, as stock are very fond of it.

Galleta or **Black Grama** (*Hilaria mutica*).—Up to a few years since this grass was not growing in any considerable quantities in the southern or eastern counties, although in the northern and western counties it constituted a large portion of the pasturage. Now, however, it has established itself in all the sections, and stockmen report more of it this year in Taylor, Callahan, Eastland, and Runnels counties than was ever seen before. It is an important grass on the Staked Plains. In Mitchell County it grows as well on the highest as on the lowest pastures. Immediately on the line of the Texas and Pacific Railroad, in the latter county, is the Iatan Valley, and a few years ago there were several thousand acres of this grass growing there, practically to the exclusion of other sorts. The stiff red clay soil seemed peculiarly fitted for its growth. Stockmen in that vicinity were in the habit of cutting it every year; it made an excellent quality of hay, much valued by the livery-stable men of Colorado City and Big Springs. It was in fact preferred to the baled hay shipped from other sections of Texas. Now comparatively little of this grass is available for hay purposes. It is recognized by all stockmen as being a valuable pasture grass.

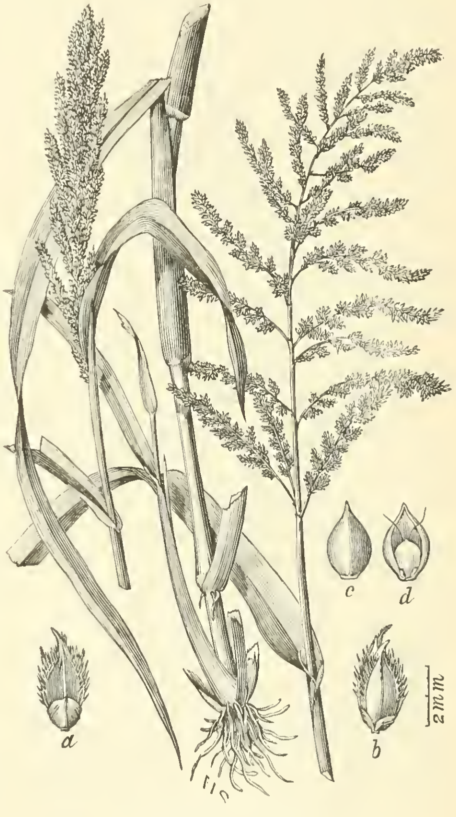


FIG. 5.—Barnyard Grass.

Alkali Saccaton (*Panicum bulbosum*).—There is but little of this grass in central Texas and stockmen do not know much about it. Farmers report that it only recently made its appearance in cultivated fields. It will prove a valuable hay grass, though it is light for its bulk when cured. The specimens gathered grew on a valley farm in Eastland County.

Barnyard Grass (*Panicum crus-galli*) (fig. 5).—The local names for this are goose grass and sour grass. It grows best in moist soils, in the prairie and Southern States, but until about 1893 was unknown in central Texas, so far as reported. That year it made its appearance in several of the counties, and was supposed by farmers to be Colorado grass (*Panicum texanum*). It is found only in cultivated fields, or in the immediate vicinity of barnyard buildings. It grows in bunches from two to four feet high, makes a great deal of fodder and seeds, and when cured is soft to the touch. Cattle eat it with evident relish. It has a great many small roots that spread out near the surface of the ground. One farmer referring to it said: "It is easy to rid a field of it, as it can be kicked out of the ground roots and all, or easily knocked out with the back of a hoe." Specimens were collected in Jones, Taylor, Eastland, Nolan, and Shackelford counties. Under cultivation it will doubtless prove to be a great hay grass.

Beardless Barnyard Grass (*Panicum crus-galli muticum*) grows best in wet lands from Louisiana to southern California and as far north as the Dakotas. It is similar in appearance to the common barnyard grass, having about the same habit growth, about the only difference being its beardless "seed-heads." Farmers who are familiar with it regard it as a promising hay grass for wet meadows.

Cotton-top (*Panicum lachnanthum*) is found in cultivated fields and grows from 16 to 32 inches tall. Its appearance indicates that it is a good hay grass. It has an upright habit, an abundance of leaves, soft stems, and many seeds that do not drop readily. It is rather light in weight considering its bulk, but stock seems to relish it when cured. It was not found growing in pastures, being entirely eaten out by cattle.

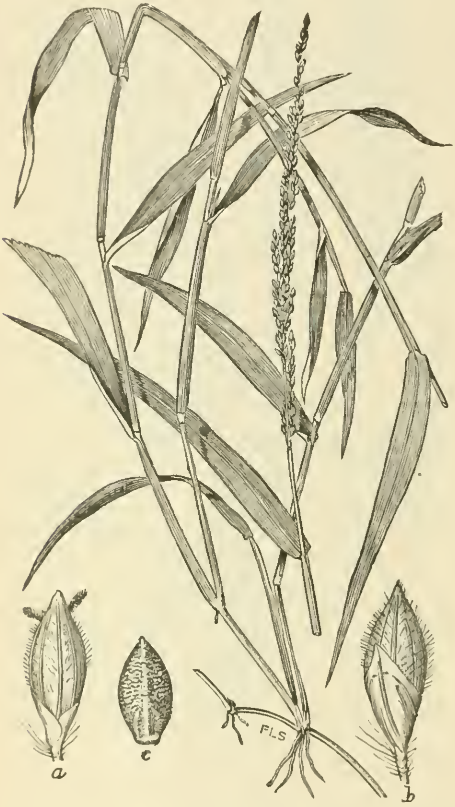


Fig. 6.—Colorado Grass.

Chaparral Millet (*Panicum reverchoni*) grows on the highlands, in pastures, and in cultivated fields. Although not a tall grass and producing but little fodder, its stems are soft when green, not harsh nor stiff when cured, and it ripens an abundance of seed. It is an excellent pasture grass that stands the dry weather well, and as such is especially valued by stockmen. If cultivated it might develop into a good hay grass.

Hurrah Grass (*Panicum reticulatum*) occurs only in cultivated fields or along the roadsides. It is not well known either among the stockmen or farmers. A farmer in whose field it occurred says that he has been observing it several years and esteems it highly. Cattle and horses relish it dry or green, and it is a promising hay grass. It would doubtless show a large yield under proper cultivation because of its abundant leaves and soft stems. It seeds freely in September, but the seeds quickly shatter.

Colorado Grass or **Concho Grass** (*Panicum texanum*) (fig. 6).—It is doubtful whether this can properly be classed as a native of central Texas, though there are many farmers, especially in Tom Green, Concho, Runnels, Coleman, and Brown counties, who insist that they have had it in their fields, a native growth, for a great many years. It is now common throughout this section in cultivated fields. It does not ordinarily make its appearance until such field crops as Indian corn are about ready to be "laid by." Then it covers the ground, and by the time the corn is ready to be gathered it is nearly ready to be cut. Farmers here are beginning to "lay by" their corn with special reference to this grass. That is to say, when they plow it the last time they leave the ground as smooth as possible without furrows. Later they cut the corn, leaving as little of the stalk as practicable, so that the grass may be mowed, thus securing a hay crop hardly less valuable than the corn. In an oat field of about 7 acres the Colorado grass grew 18 to 24 inches tall and yielded a fraction under 2 tons of hay per acre besides the grain. All classes of stock relish it and it is very nutritious, but left too long it dries out and sheds both its leaves and seed. It was first observed many years ago growing in the valleys of the Colorado River in Travis County, where the farmers regarded it as the best of all their hay grasses. It is a grass that does not have a weedy habit, and land can easily be freed from it in one season by following with cotton, but few farmers care to get rid of it under any circumstances.

Switch Grass (*Panicum virgatum*) grows in low places, on the banks of creeks, near tanks and pools, or in valleys where there is moisture. It is also reported from the moist uplands. Stock eats it, especially when it is young, and after it matures they eat the seed heads and pick off the leaves. The great abundance of the latter is a marked characteristic of this grass. Specimens were secured at the Seven Wells, in Mitchell County, which measured fully 7 feet tall. In a pool near Baird, in Callahan County, it was growing fully 6 feet in close compact bunches. After the grass is seeded the stems are rather coarse and harsh, and stock no longer relish them. If cut before it gets too old it makes a hay of fair quality.

Water Grass (*Paspalum pubiflorum glabrum*) is a strong growing perennial which ought to make a good hay grass. It was noted only in the valleys, but a well-informed farmer of Eastland County, on whose place the grass occurs, reports that it also grows fairly well on the uplands. It is found in most of the counties of central Texas. It often grows 4 feet high, and as it produces a great abundance of soft leaves it is regarded as a superior grass. Meadow lands seeded down to it would undoubtedly produce in favorable seasons quite as much hay as an equal acreage of alfalfa or Colorado grass.

Texas Crow-foot (*Leptochloa dubia*).—An excellent grass found in Nolan County. It is worthy of being cultivated. Farmers in other counties to whom the Nolan County specimens were shown say that they have it growing on their farms, respectively in Taylor, Jones, and Runnels counties. It is a promising hay grass.

Drop Seed (*Sporobolus cryptandrus*).—Found in several localities, but always in moist soils. Specimens were collected on the shores of Lytle Lake, in Taylor County, near the Seven Wells, in Mitchell County, on the Clear Fork of the Brazos, in both Jones and Shackleford counties, and on the Sweetwater, in Nolan County. It ripens but few seeds. The leaf blades are narrow but abundant. It is a bunch grass, a single clump sometimes being 12 inches in diameter. Stockmen report that all classes of cattle eat this grass with evident relish, especially before flowering and in the winter when it is cured.

There are a great many other grasses that have value either for hay or pasture purposes, or both, but those above enumerated are believed to be the most meritorious of those native of central Texas.

FORAGE PLANTS NOT GRASSES.

Stolley Vetch (*Vicia leavenworthii*) is a forage plant of decided value. It appears very early in the spring, and bears pods filled with small peas. It is eaten by stock in the spring and early summer. As late as September fair specimens of it were collected, but not in condition to be eaten by stock. The peas had shattered out and much of the foliage had fallen from the stems. It is to be found in most of the pastures in this section, and is known locally by a variety of names. One farmer claimed to recognize it as the Butterfly pea that grew in his native State of Georgia, but the vetch has the twining habit of a vine while the pea grows erect. A stockman who has held stock in Arizona and New Mexico says that a similar vetch grows there and is known as the Buffalo pea, while a farmer from Louisiana says it resembles the Partridge pea. Several parties near Putnam, in Callahan County, experimented with this pea last year with satisfactory results. They report that it blooms from March to the middle of May and that the peas ripen while it is still blooming, after the habit of the English garden pea. A county official of Callahan County says that several years ago in February he saw this pea in full bloom about Aledo, in Parker County, where it grows wild in great abundance.

Tallow Weed (*Actinella linearifolia*).—Every sheep raiser in all the stock counties of Texas knows the habits and value of this remarkable forage plant. It is not a very common growth, but occurs in almost every one of the counties in this section of Texas. It has somewhat the form of young lettuce when it first appears. Later it puts out a yellow blossom that fills the air with its rich perfume. Still later it forms a seed head resembling somewhat that of a yellow clover. It flowers in the early spring and is ready for all kinds of stock in advance of any other weed or grass. Some of the accounts given by enthusiastic stockmen as to its merits are almost too wonderful to be fully credited. For instance, one who has a ranch on the Clear Fork of the Brazos, in Jones County, says that a few years ago, when a hard, wet winter had followed on the heels of a very dry summer, the little grass that was available rotted before Christmas, and, having laid up no hay, grain, or other winter feed for his stock, he was gravely apprehensive that he would lose a great many of them before the early spring weeds and grasses would appear; but his range, it seems, was well seeded with the tallow weed, which continued to grow all the winter, and not only kept his stock alive but fattened them. He declares that when the spring opened he had beef steers fat enough to be put on the market, fattened entirely on this plant. A sheep raiser of Tom Green County, in 1892, had his sheep on a ranch that was in both Tom Green and Crockett counties. During the early winter of that year his ranch on the Concho River, in Tom Green County, where he was then holding his sheep, was overflowed and he lost all the hay and grain he had laid up as winter feed for his stock. The roads from his ranch to the railroad were impassable on account of the frequent and heavy rains. Practically all the grass on his Concho River ranch was rotted by the rains. By midwinter his sheep were so thin that it looked as though most of them would die from starvation before spring. Early in January he started his sheep to this Tom Green and Crockett County ranch. He found there, early in January, quite a large proportion of this range covered with tallow weed just beginning to bloom. Up to that time he had no knowledge of its habits and value, but as his sheep ate it with evident relish; as there was nothing else for them he permitted them to eat their fill of it. In a short time they showed signs of improvement and by the first of March, when the weed was in full bloom, they were in satisfactory condition. Naturally this rancher is a firm believer in the tallow weed, which, according to him, "will put more tallow on the kidneys of any kind of stock than the same bulk of any other forage plant that ever grew in any country under the sun." So far as known the tallow weed has never been cultivated in this section, and as it rarely grows very tall on the range no effort has been made to cut it for hay. In a cultivated field it will grow tall enough to be cut for hay which will be equal to the best. No chemical analysis of tallow weed has been made, but a forage plant that will, while green, fatten sheep and cattle, without other feed, in the winter and early spring must when properly cured prove very nutritious.

Fall Tallow Weed (*Amblyolepis setigera*).—Found in October growing luxuriantly, protected by a brush fence, on a ranch about 5 miles north of Abilene. When within 200 yards of the spot where it was growing the familiar, rich, pungent, thoroughly agreeable perfume characteristic of the true tallow weed (*Actinella linearifolia*) could be recognized. That found as above stated was growing much after the habit of the clovers. It promises to be a superior hay producer, and may be recommended for cultivation by farmers and stockmen.

Careless Weed (*Atriplex oboratum*) grows anywhere and everywhere all over central Texas. It often grows in soils too strong with alkali for grasses. While not stating authoritatively that it prefers alkali soils, yet it does thrive under such conditions, and the suggestion is ventured that it may have a special mission worthy the consideration of stockmen and farmers—to reclaim alkali lands. It grows tall enough to be cut, and both its leaves and small twigs are eaten by stock. I know of no instance where stock have had to depend upon it entirely for food, but as a rule they know what is nutritious, so that it is quite probable that the "Careless Weed" has a special value as a forage plant. A reliable sheepman of Concho County says that sheep eat it greedily. It produces enormous quantities of seed, and every year reseeds the land where it grows. A Mitchell County sheepman thinks that sheep eat it because of its tonic properties. It has a bitter principle that suggests such an idea. On the high plains of Nevada and Utah, and in Arizona and New Mexico a similar species (*A. palmeri*) furnishes a considerable part of the winter forage for both cattle and sheep. Cattlemen who have held cattle on the range in Arizona say that a salt bush, sweet sage (*A. canescens*), very similar to this in many respects, is a principal reliance in that section for all classes of stock.

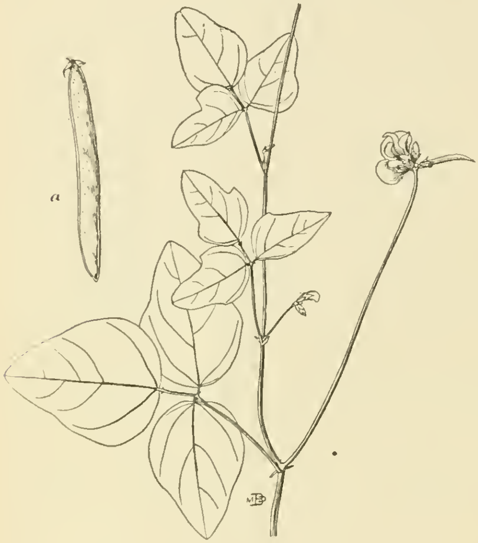


Fig. 7.—Wild Bean.

Beggar Weed (*Desmodium paniculatum*).—There is some prejudice in the minds of many persons against this excellent forage plant because of the fact that its seeds have a way of fastening themselves to one's clothes. But this is only an incident that ought not to be considered in deciding upon its value for forage. The fact is, horses, cattle, and sheep are all fond of it. It thrives best in low and moist soils, but it is also to be found on the uplands. The specimens collected grew in a rich, moist, sandy loam. The stems are rather inclined to be woody, but when growing thickly, as frequently happens in this section, the entire bush is easily convertible into hay. As a renovator of wornout soils or as a green manure no better nor cheaper fertilizer can be used than to turn under the rank growth of the beggar weed. The tap root descends deeply into the soil, bringing up mineral fertilizers from the subsoil which can be utilized by other crops. As it makes an excellent quality and a great abundance of feed for stock, it is recommended that farmers and stockmen familiarize themselves with the habits and general good qualities of this beggar weed.

Wild Bean (*Phaseolus helvolus*) (fig. 7) is found on low moist lands throughout central Texas. The vines are frequently seen clinging to tall trees and growing up to their very tops. One such vine in Eastland County measured nearly 50 feet in length. This bean furnishes a large quantity of fodder that is eaten by cattle and sheep. It is a perennial with slender stems, and if properly cultivated will prove a very valuable addition to the forage plants of this section. It grows best in woodland copses along the banks of streams or in low moist valleys where it finds tall and strong weeds or grasses upon which to cling.

Needle Grass or **Dog-town Grass** (*Aristida fasciculata*).—There is an impression which obtains among other than cattlemen that this grass is a nuisance rather than an advantage to the range. But a careful investigation demonstrates that it is one of the most valuable, all things considered, of the pasture grasses found in this section. It is true that the needle-like seeds when ripe render the grass in some respects objectionable. For instance, they attach themselves to the wool of sheep, work their way through it to the bodies, and inflict on them ugly wounds that not only cause serious inconvenience, but sometimes result in real injury to the animals. Especially is this the case with lambs. Again, no class of stock seems to relish the grass while the needles are still attached. Cattle eat it at such times when forced to do so because of the scarcity of other grasses, but sometimes the needles pierce their tongues and otherwise wound their mouths. However, the damage done to cattle and sheep in this way has undoubtedly been greatly exaggerated. On the other hand the good qualities of the grass have been greatly underestimated. It is one of the most common pasture grasses in this section. It is less subject than any other to the destructive tendencies of prairie dogs. Owing to the peculiar beards on the seeds, this grass reseeds itself after all other grasses have been destroyed by the dogs near their holes. The seeds, when shed from the stems, are blown over the ground, fasten themselves to the earth, and work themselves down into it. As they are blown about over the range they fasten themselves to bare spots, which are the result of many different causes, and so renew them. It has been suggested by some stockmen that a very good way to speedily renew all our ranges would be to run furrows from east to west at short intervals through them. These furrows would catch the drifting seeds of this and other grasses as they are blown along by the prevailing south winds. The seeds would readily attach themselves to the loose soil of these furrows. This would assist the natural tendency of the ranges to renew themselves. But, aside from these considerations, this grass has another special value. It is one of the first of all the range grasses to become green in early spring. It affords good feed to all classes of stock while the grass is young and before the seeds become stiff and troublesome. That it possesses very nutritious qualities no one familiar with it will deny. Indeed, some of the best informed stockmen of this section say that they regard it, when stock can eat it safely, as being quite as fattening as the curly mesquite. After the seeds are shed there is no better grass on the range. It has the habit of the curly mesquite of curing on the roots. No matter how dry it may look to be, after a warm rain it will green out to the end of its blades and stems. Some say that horses and cattle will not eat it after it has shed its seed and has dried out. This, however, is a mistake. To satisfy himself on this point the writer has been on the range with a view especially to ascertain the fact, and has seen cattle, horses, and mules all eating it greedily under such conditions. One of the best informed stockmen of central Texas, when asked his opinion on the value of this grass, said: "It is about the earliest of all our pasture grasses; it is as nutritious as the best; stock eat it before the seeds become harsh and after they are separated from the stems: and it contributes more than any other grass to the annual renewal of the range. It is a main reliance with the cow men throughout this section. I regard it as one of the most valuable grasses for general purposes that we have."

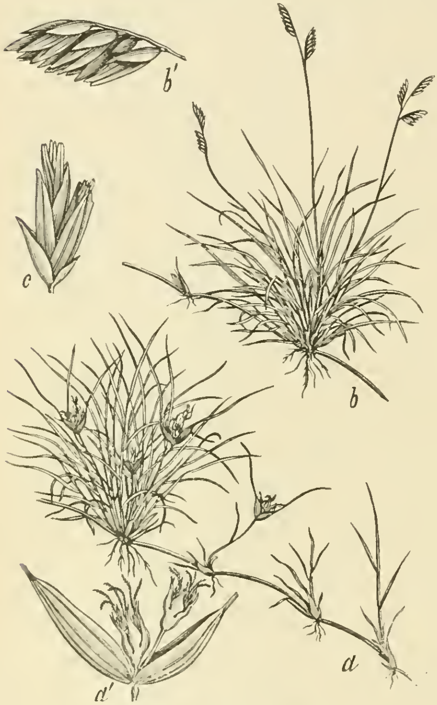


Fig. 8.—Buffalo Grass.

Buffalo Grass (*Bulbilis dactyloides*) (fig. 8).—It is more than probable that stockmen frequently mistake this grass for the different varieties of grama. It is a very common grass throughout central Texas, which is not the case with the gramas. Certainly in this sectionit is more valuable than the others, since it furnishes very much more stock feed than any, or indeed all, of the gramas put together. There are many who perhaps esteem the buffalo grass more highly than it deserves; but there are more who do not give to it the credit to which it is really entitled. A range well seeded down to it, with curly mesquite and needle grass, is an ideal stock range so far as the grasses are concerned; and it is a very common thing in all this section to find just this combination. The greater the variety of pasture grasses the better the range for practical purposes, but stockmen in this section would not willingly exchange these three for any other mixture.

GRASSES AND FORAGE PLANTS OF PROBABLE VALUE.

In addition to the above 34 varieties of grasses and forage plants, the following are worthy of being carefully studied by farmers and stockmen:

Bur Grass (*Cenchrus tribuloides*).—This is another grass that is much abused, even by well-informed stockmen, on account of its peculiar thorny bur-like seeds, and because in cultivated fields it is a bad weed. It is pretty well distributed throughout the United States, east and west. In this section it has a real value that more than offsets its disadvantages. That is to say, it withstands dry weather better than many of the other grasses found here. A great deal of it was seen in September on a range in Mitchell County. Every pasture grass except those in the moist valleys was looking dry and cured except bur grass. The latter was as green as a young wheat field, and loaded down with seed. In traveling over this section, in September and October, whenever one notices an especially green spot on the range it may safely be assumed, without examination, to be the bur grass. After it has shed its seed it is relished by all classes of stock, and stockmen, while finding much fault with the seed, agree that it is very nutritious. It is also valuable when young or before the bur-like seed is formed.

Wild Millet (*Chaetochloa italica*) is found as a weed in cultivated land, in Nolan, Taylor, and Eastland counties. It grows, under such conditions, to be from 18 to 30 inches tall, seeds freely and produces a fair amount of fodder. It has the appearance of being a good hay grass. Its growth as a weed indicates somewhat the adaptability of millet and Hungarian grass to these central Texas soils.

Sedges (*Cyperus* and *Carex* species).—These are not true grasses, technically considered, but are so regarded by stockmen in this section. They are distributed over a wide extent of country, and while occurring chiefly in the low and moist valleys, there are some that grow well on the uplands and even among the rocks. Stockmen do not as a rule value the sedges highly for pasturage, because while they become green in early spring and stock eat them until the seeds commence to form, they do not supply a lasting forage. By that time other and better grasses abound, and stock do not then care for them, and will not eat them if they can get anything else.

Bog rushes (*Juncus* species).—These also are not true grasses, although from their grass-like habit they are so regarded by stockmen. The most common sort grows on high and rocky places. They produce many seeds that do not drop readily, and the stems are slender, but rather harsh, and produce little fodder. An intelligent farmer says that these rushes are eaten by cattle, and possibly some of them are of value as low-ground forage plants, as are the sedges.

Satin Grass (*Muhlenbergia tenuiflora*) was first found in Eastland County, but it has since then been reported from several other counties of this section. While not common, it is here in sufficient quantities to entitle it to consideration. There is much difference of opinion among farmers as to its merits. It is not met with except on farms, growing near streams. Stockmen who are not also farmers do not appear to know anything about it. It produces an abundance of foliage and soft stems, and ought to make good hay. Specimens from Eastland County were nearly 3 feet high. After being fully cured it is soft, has a rich smell, and seems in many respects equal to the best native grasses of this section. It has slender, erect stems, long, narrow leaves, strong roots that take firm hold in the earth, and few seed (in September). If cultivated it might prove to be a fairly good hay grass.

Grapevine Mesquite (*Panicum obtusum*) grows in most of the counties of central Texas. It has long, creeping, jointed stems that root wherever they touch the ground, scanty leafage and that rather harsh, and a fair quantity of seed that clings well to the stems. It grows in this section from 18 to 24 inches high. There were no indications of its having been eaten by stock, although an observing farmer says: "They do eat it when they can't get anything better." Mixed with other and softer grasses it will perhaps prove of some value.

Crab Grass (*Panicum sanguinale*).—It is scarcely necessary to discuss this well-known grass, for whether a native of this section or not, it is here in great quantities and is a pest or a blessing according to the point of view from which it is considered. Growing in cultivated fields it is not very troublesome until corn and other field crops are about to be "laid by," when it asserts itself vigorously. Once it gets a foothold in a field it soon occupies every foot of the ground. This is the unfavorable view to be taken of it. On the other hand it furnishes a great abundance of excellent pasturage for all classes of stock. That it is nutritious can not be seriously questioned. Excepting on soils where it is not desirable for stock to run after field crops are gathered, this grass is valuable, adding largely to the capacity of farms to support the cattle. One class of farmers here insist that it is an unmitigated pest. Others say that while they would not deliberately introduce it on their farms, they are satisfied to have it remain. A few have expressed themselves as preferring it, one of these stating that both for pasturage and hay purposes a field well seeded to crab grass was, in his opinion, worth more year after year than the value of any other crop that could be grown. On the whole, it may be regarded as an excellent hay grass primarily, and incidentally as a good pasture grass.

Knot Grass (*Paspalum distichum*) (fig. 9) has a local name that, in a sense, very aptly describes it, "Eternity grass." A farmer on whose ground this grass was growing luxuriantly, when asked why it was so called, pointed out a stem of it and invited the writer to trace it back to the original root. He followed it through a dense matting of other stems fully 20 feet and gave it up. The farmer suggested that it be traced the other way, and again he failed after following it in the other direction about 20 feet. The farmer then explained: "Eternity is defined as 'without beginning and without end:' if this grass has any beginning or any ending it is difficult to determine it." It grows in low, moist places, especially where periodically flooded. Owing to its creeping habit, it is not easily cut and hence is not available for hay purposes. One farmer gravely stated that stock would not eat it. Later the writer visited his pasture where the knot grass grew luxuriantly. The grass was abundant. and while there were many varieties of rich grasses all around, his horses and cattle were hunting for and eating every little sprig of it that they could find. This conclusively demonstrated that knot grass is valuable and worthy of consideration by stockmen. The creeping stems often measure 20 to 30 feet or more.

Wild Oats (*Uniola latifolia*) is an ornamental as well as a very valuable forage grass. It was seen only in one place in Eastland County, where it had made a luxuriant growth along the banks of small streams. Under the shade of the trees it stood from 36 to 48 inches high, and in September it was as green as a wheat field in spring, with every stem loaded with seed. The farmer at whose place it was found, in order to prove that it possesses special value, led a Jersey bull that he had tethered on crab grass near by, and turned him out where this wild oats was growing. The bull ate it greedily. Judging from appearances it ought to be a very valuable hay grass.

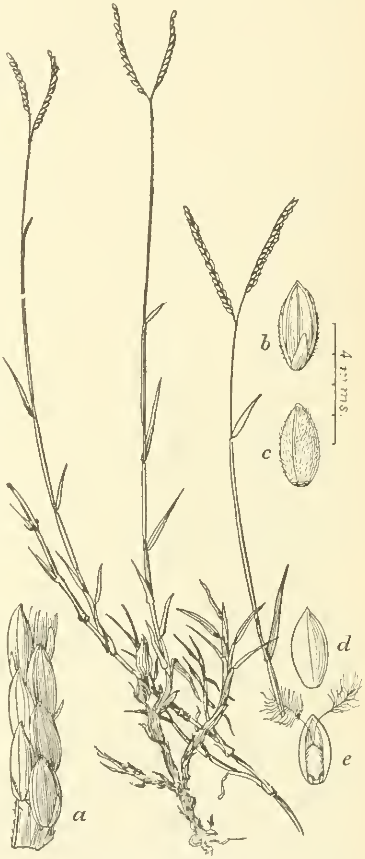


Fig. 9.—Knot Grass.

Prairie Sage Brush (*Artemisia ludoviciana*) is a showy forage plant which grows throughout this section. It may not have any very decided value for stock purposes, though stockmen say that cattle eat it. A sheep raiser says that sheep are fond of it and fatten on it. A Mitchell County farmer says that it grows well in alkali soils where little else will thrive. It is probable that it can be utilized with other plants for the purpose of reclaiming such lands.

Butterfly Pea (*Clitoria mariana*) was seen in several counties in this section. It has a light purple blossom and forms a pod that fills with peas nearly as large as the small garden pea. It grows upright and stands erect. When cut and cured it makes a soft and rich hay that is eaten by cattle and other stock. It grows principally in low, moist soils and on the banks of streams. A farmer in Eastland County says that some years his meadows were covered with it, and that a field planted to it and cultivated would yield several tons of good forage per acre. He thinks it will not withstand the long dry spells to which this section is periodically subject.

Bushy Knotweed (*Polygonum ramosissimum*) first attracted the writer's attention because of its enormous production of seed. Bushes of it found in pastures appeared to have been grazed. Cattle are fond of it when it is young and sheep will eat it whenever and wherever they can get it. It flourishes under many and varied conditions on high and low lands, in rich or poor soils, and withstands drought well. A stockman who has been much in Montana and other Northwestern States says that this or a similar weed grows there and furnishes nutritious forage throughout the summer and early autumn months. It is an annual, growing here from 15 to 30 inches high, according to the soil. A Callahan County farmer says that when mixed in with the hay grasses of the section it adds to the value of the hay, as its seeds are rich in fattening properties. He furthermore says that when cured its stems are very stiff, and only the seed and leaves are relished by stock. It deserves favorable consideration by farmers and stockmen.

Woolly Plantain (*Plantago gnaphalioides*).—There is much difference of opinion here as to the value of this plantain. In September its erect stems are loaded with seed. A Mitchell County stockman says it is always about the earliest spring forage and that cattle then eat it readily. It is usually to be found only in winter pastures where cattle have been kept for months. On the other hand, some regard it as a pest, though admitting that stock sometimes eat it.

Purslane (*Portulaca oleracea*) grows in every county in central Texas and is known locally as "hog pusley." It prefers fallow ground and is to be found in all the fields, but also grows well in pastures, especially in sandy soils. It stands dry weather well, and no matter how dry the grasses and other weeds may be its fleshy leaves and stems are abundantly in evidence. There is no doubt as to its value as a forage plant. Hogs will fatten on it and sheep are fond of it. Cattle do not appear to care for it particularly except in the droughty autumn months, when its succulent herbage is greedily sought for.

Cotton Purslane (*Portulaca pilosa*) is another variety of purslane that is a native of and grows abundantly throughout this section. It is a smaller plant than the other species above mentioned, but has about the same value as a forage plant.

COMMON GRASSES OF LITTLE FORAGE VALUE.

The following grasses, natives of central Texas, while perhaps less valuable than those above described, are worthy of consideration:

Triple Awn (*Aristida arizonica*) resembles in some respects the well-known needle grass (*A. fasciculata*). It is an upland rather than a valley grass. It is more frequently found in sandy and gravelly land, and has economic value both as a pasture and hay grass. It is not very common in this section, but becomes abundant farther west.

Crow's Foot (*Chloris cucullata*) is a showy grass known locally as "crow's foot" on account of the shape and general appearance of its seed head. Although it produces a fair quantity of leafage and soft stems, it is not considered to have any value for either pasture or hay.

Feather Crow-Foot (*Chloris alba*) was noted in only one locality in Nolan County. The specimens secured were about 32 inches high, with an abundance of soft leaves and small seeds. It is a very ornamental grass, but is not worth much for forage purposes, as it is not eaten by cattle as long as better grasses are available.

Love Grass (*Eragrostis pilosa*).—This is not a common grass in this section and is not regarded as possessing much value.

Stink Grass or **Candy Grass** (*Eragrostis major*) is well known throughout this section. With its feathery looking ornamental "seed head" and abundance of leaves, it would produce a large amount of light hay, which, however, is not considered very palatable because of its somewhat offensive odor.

Love Grass (*Eragrostis secundiflora.*)—This resembles the Candy grass, but is less frequent in this section. It grows in saline and strong alkali soils, and has little forage value.

Muhlenbergia arenicola is found in many different situations in this section, in the valleys, on the foothills, in rich soils, and among rocks. It resembles needle grass (*Aristida fasciculata*) both in appearance and habit; and while not well known here it is considered a valuable early pasture grass. Stockmen state that it greens out very early in the spring, withstands summer droughts, and is relished by stock. It seems to prefer the higher and drier uplands.

Old Witch Grass or **Tickle Grass** (*Panicum capillare*) is very abundant in this section. It prefers sandy soils and cultivated fields. It is a very showy grass, and stock will eat it when it is young, but it is not nutritious, and is therefore not very valuable.

Hairy-flowered Panic (*Panicum ciliatissimum*) is not properly appreciated by stockmen in this section. It will not produce a great abundance of hay, but the hay is rich and soft, and stock eat it with evident relish. It weighs light considering its bulk, but will do well to mix with other hay grasses. A specimen collected in 1897 measured 42 inches in length. It has the creeping rather than the erect habit, and is certainly a fair pasture grass. It is not a very common grass in this section. Locally known as carpet grass.

Brown Top (*Panicum fuscum*) is a tall hay grass which when young is eaten by cattle and horses. It grows chiefly in cultivated fields, and is similar in its habits and appearance to the barnyard grasses. It is valuable and ought to be cultivated in this section, and may well repay all the labor that may be bestowed on it by developing into a first-class hay grass.

Hall's Grass (*Panicum hallii*).—There are several varieties of grasses common in central Texas which resemble each other so much that only experts are able to distinguish their differences. They all produce a great abundance of small seed, one of their marked characteristics. Hall's grass is one of them. It grows in all the counties of this section, is a fair pasture grass, and, while not so tall as some of the other varieties mentioned, it will produce a lot of soft and nutritious hay. Farmers and stockmen speak of it in favorable terms.

Sporobolus drummondii was noted only in Taylor County, although it occurs elsewhere in central Texas. It grows tall, with long, slender leaves, and in September had no seed and no appearance of having had any. The farmer on whose place the specimen was collected says that stock are fond of it when it is young, and he thinks it is perhaps valuable both for hay and pasture purposes.

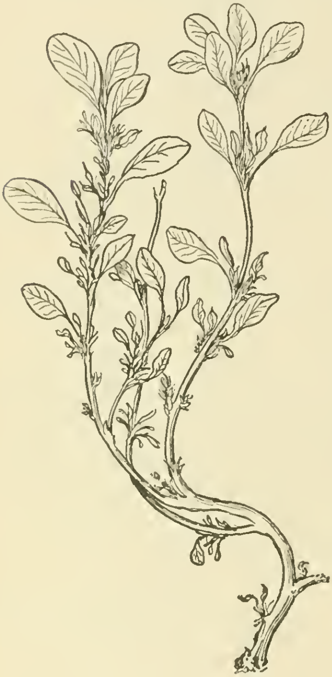


Fig. 10.—Tumble Weed.

Fall Redtop (*Triodia seslerioides*) grows in moist soils, especially near streams, in several counties in central Texas. Specimens from a valley in Eastland County measured 88 inches in height. It will furnish a great abundance of seed and soft leaves. Its stems are not large nor are they harsh even when cured. As a hay grass it may be worthy of special attention. An acre of good, moist valley land seeded down to it ought to furnish several tons of hay in a good season.

Gunaninpil (*Allionia incarnata*), a "four o'clock," is generally regarded as only a flower, but as an early summer feed, especially for sheep, it has a recognized value. It will grow again after being eaten down to the roots and withstands dry weather—two good qualities.

Tumble Weed (*Amaranthus blitoides*) (fig. 10) is not properly appreciated by stockmen. It grows extensively in all the counties of this section, and will readily be recognized by its name as above. When matured it either breaks from its roots or is blown out of the ground by the winds. Gathering itself into a ball it goes tumbling over the ground until stopped by wire fences or other obstructions. Hundreds of these plants may frequently be seen on the broad open prairies of Texas like balls 2 to 4 or even 5 feet in diameter, rolling before the wind like an army of living beings. When young it is greedily eaten by cattle and sheep, and furnishes a nutritious food. A farmer who has had some experience in the matter of silos suggests that the tumble weed, if cut while young and converted into silage with other forage plants, would add much to the quantity and something to the quality of the product.

Water Purslane (*Ammannia coccinea*) is not a common plant in this section, but is to be found in wet places throughout central Texas. It has a harsh stem, few leaves (in September), but a great many seeds, that cling tenaciously to the stem. A Jones County farmer and stockman reports that stock eats it in the spring. The plant is worthy of being investigated.

White Sage, Sage Brush (*Artemisia mexicana*) grows in all the counties of this section. Opinions differ as to whether or not any kinds of stock eat it, but the most observant stockmen and farmers are satisfied that they do, at least in winter. It is quite probable that this and other closely related sage bushes supply some feed on the winter ranges.

Ground Plum (*Astragalus crassicarpus*) (fig. 11).—Several varieties of this and closely related plants grow abundantly in central Texas. They have bean-like, purple and white flowers, and pods containing many seeds which rattle in them when ripe. Before ripening, the green and succulent pods are eaten by cattle and horses, which improve in flesh from the time these plants begin to appear. They grow abundantly in Eastland and Shackelford counties, and wherever they occur add much to the value of the forage on the ranges.

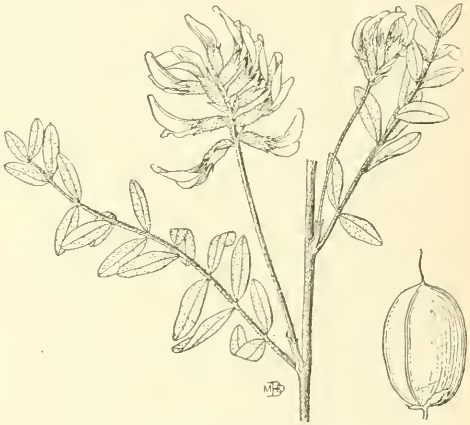


FIG. 11.—Ground Plum.

Fox Sedge (*Carex vulpinoidea*).—This is rather a common growth in most of the counties of this section of Texas. It grows to be 2 to 3 feet high and bears an abundance of wide leaves. Cattle relish it and sheep raisers say that sheep are fond of it when it first greens out in early spring.

Star Thistle (*Centaurea americana*).—There is much difference of opinion in regard to the value of this plant. Some of those who ought to know, insist that it is not worthy of consideration, while others claim with equal earnestness that it is one of the most valuable early forage plants of this section. A Callahan County farmer says that in the early spring of this year (1897) he was becoming apprehensive that his home bunch of cattle would suffer for feed before the grasses and weeds on which he usually relied for their early spring sustenance would appear. His milch cows, which were then being given the range of his fallow land as well as of a small pasture, instead of becoming thin improved in flesh and the milk flow considerably increased. They came to the pens at night with their stomachs distended, and chewed the cud as contentedly as if they had been grazing in a first-class pasture. Investigating the matter, the fields and pastures were found to be covered with a weed from 3 to 6 inches tall, in appearance like a young tobacco plant, apparently this star thistle. The cows were eating of it greedily. Later it put up many stems from each root that grew to be from 2 to 3 feet tall. The flower was yellow and white and the seed head, when ripe, at a distance resembled that of the wild sunflower. Matured specimens of star thistle were found in great abundance in Callahan, Shackelford, Eastland, Taylor, Jones, and Nolan counties and were identified by various farmers as this forage plant. A farmer who resides in Burnet County saw it growing in Callahan County and says that the farmers of his neighborhood esteem it very highly as an early forage, especially for milch cows.

Lamb's Quarters (*Chenopodium album*).—A common weed throughout this part of Texas. When young it is used by housewives as a salad, but farmers here regard it as a valuable forage plant for cattle. It grows in pasture lands as well as in cultivated fields, appearing in early spring.

Grandpa's Beard (*Clematis drummondii*).—This vine has some value for forage purposes, as cattle often eat the leaves. Its fruits are very showy and give to the plant its common name, as above.

Wild Sages (*Croton* spp.) grow abundantly in this section, and if valuable for forage purposes the fact should be definitely determined and made known. Some farmers here say that cattle and sheep both eat them. On the other hand there are those who regard them as poisonous. It is possible that these sages have been confounded with other aromatic perennials which have much the same appearance and odor but which are known to be harmless.

Red Root Sedge (*Cyperus erythrorhizos*).—A species of sedge that occurs in many parts of this section and is believed to be a good forage plant. It grows 2 or 3 feet high, has a strong root, stools out like wheat, and forms large bunches of leafy stems which stock of all kinds eat. If cut before it becomes too old it will produce a large amount of nutritious hay. It grows only in wet or marshy meadows.

Hog Nut, Chufa (*Cyperus esculentus*).—A sedge that appears in early spring in low places. It produces tubers similar to those of the blue weed, though in much larger quantities. Hogs are fond of these and will root up the ground in their search for them. In some sections of Texas it is cultivated especially for hogs, and the tubers are said to contain large amounts of starch, oil, and sugar. As it withstands dry weather well it is recommended for cultivation in sections subject to periodical droughts, with the caution that it may, like Johnson grass, be difficult to eradicate when once established.

Ephedra nevadensis belongs to the same general group as the pines, firs, and spruces. It grows throughout this entire section, but is not very common. It is generally found on the high lands and, as a rule, on rocky or gravelly soil. It has a bushy growth, its forage being an abundance of slender stems, branching out from the main stem. It is known to possess extraordinary qualities, being an excellent blood purifier. Among the Mexicans and "old timers" of this part of Texas it is used to make a tea that is said to be palatable and is known to be healthful. Cattle eat it greedily, so that it may be considered valuable as a forage plant.

Alfilaria (*Erodium cicutarium*) (fig. 12).—A former hay contractor at Old Fort Griffin states that he is thoroughly familiar with this plant and that to his certain knowledge it grows quite abundantly in certain sections of central Texas. Other stockmen who are familiar with the range in New Mexico and Arizona also state that they have met with this plant in this part of Texas. The probabilities are that this plant or *Erodium moschatum* or both, may be found. If so, stockmen will have good reason to be gratified, as "filaree" is known to produce excellent forage, relished by stock.

Winter Fat (*Eurotia lanata*) is not very common in this section, but is found on the prairies in the northern and western counties of Texas. It is a fine winter forage plant and thrives in soils strongly impregnated with alkali. Both cattle and sheep eat it and do well on it.

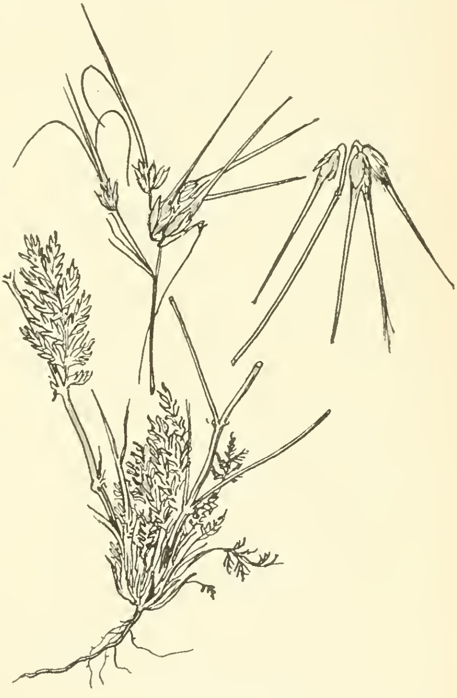


FIG. 12.—Alfilaria.

Rosin Weed or **Gum Weed** (*Grindelia squarrosa*) is worthy of notice, because its stems, leaves, and flowers exude a gum that is very sticky. Stockmen regard it as very much of a nuisance, because the manes and tails of horses, the wool of sheep, and the heads and tails of cattle frequently become gummed up with it, to the no small discomfort of these animals.

Dwarf Broom Weed (*Gutierrezia sarothræ microcephala*).—A well-known plant, recognized as having fair forage properties, since stock eat it to some extent.

Sunflower (*Helianthus annuus*) is said to be an introduced weed here, but however that may be, it is now very common. It is not only very abundant here, but each year appears to be increasing. It is regarded as very much of a nuisance, notwithstanding the fact that both its leaves and seed heads make a forage that is eaten and relished by cattle, horses, and sheep. The seeds are especially rich in oil and very nutritious. It does not suffer, no matter how dry the seasons are, which fact suggests that in this section the sunflower, now much despised, may be made to cut a rather important figure in the matter of supplying forage for stock. An improved variety, having heads measuring from 6 to 12 inches in diameter, is being cultivated, the seed being fed to fowls and the fodder to cattle.

Artichoke (*Helianthus tuberosus*) is well known in many parts of Texas and grows wild on the banks of a small creek in Eastland County. It bears underground edible tubers that make good hog feed, and both cattle and horses will eat the foliage. It should be cultivated here.

Blue Weed (*Hoffmanseggia stricta*), the "Camote del Raton" of the Mexicans. Within the past two or three years it has appeared in this part of Texas, and is already regarded by the farmers as a pest. Having been informed that no cultivated crops would thrive where it grew, an investigation demonstrated the incorrectness of this popular belief. It grows in soils strongly impregnated with alkali, where such crops as wheat, oats, corn, and garden vegetables and vines will not thrive. This fact explains why they and the blue weed are rarely found growing together. A specimen was sent to the Department of Agriculture for examination by the Botanist, who says of it "I have received complaints of this plant, as a weed, from Anson, Jones County, and Murray, Young County, Tex. In both instances it is stated that the tubers are eaten by hogs and the foliage by cattle in dry weather. I do not know of any method of exterminating it other than by cultivation and thick seeding with crops that will choke it out. It is probable that grazing with sheep during dry weather would check the growth somewhat, but I do not think that it could be entirely exterminated by this means." It forms long creeping roots bearing fleshy tubers. From these tubers the roots branch out indefinitely. In the digging of a well near Escota, Fisher County, roots of blue weed with the tubers were found growing thirteen feet below the surface. As the blue weed will produce an abundance of forage and both the foliage and the tubers are eaten by stock it may be worth experimenting with in alkali soils. The tubers, however, are produced at such depths that it would be difficult to harvest them.

Wild Verbena (*Lippia nodiflora*).—A farmer and stockman of Jones County, who has about an acre of ground thickly covered with this plant, regards it quite as valuable for forage as an acre of alfalfa. He insists that it is a clover, and that it is identical with the prairie clover that is found growing a little farther west; but in this of course he is mistaken. The seed heads of the two are somewhat similar in appearance, but this is about as far as the resemblance goes. This wild verbena produces an abundance of forage, that is eaten and relished by both cattle and sheep. It deserves to be tested thoroughly to determine its qualities.

Bur Clover or **California Clover** (*Medicago maculata*).—Well known on the Pacific coast, and found growing in the vicinity of Colorado, in Mitchell County. It is supposed the seeds were brought originally into this section in the wool of sheep shipped in from California. However, it may have come from the Gulf States, where it is common. It is not here in quantities sufficient to make it worthy of much consideration at present.

Prickly Pear (*Opuntia engelmanni*) (fig. 13).—In many counties in central and southwest Texas this well-known plant grows in great abundance, often from 6 to 10 and 12 feet high. A few years ago stockmen there began to utilize it for feeding purposes. They gathered the so-called "leaves," singed off the spines with fire, and fed them with cotton-seed cake to their cattle. The leaves and fruit are often fed to sheep. In this section of Texas this plant does not grow nearly so tall as farther south, nor is it nearly so common here as there. Still it is here in considerable quantities, and must be considered in connection with other forage plants native to this section. Herders who have used this plant on the dry plains of west Texas state that sheep fed on it do not require any other food or water, as the succulent stems contain a large amount of water and enough starch and gum to sustain life. It is often asserted that cattle and sheep, fed on the prickly pear with cotton-seed meal and hay, go into the markets as fat as those fed on grain and hay. If the prickly pear be fed alone it causes laxity, and when fed to working stock, a tendency to bloat. That it is one of the most valuable forage plants of Texas admits of no question.

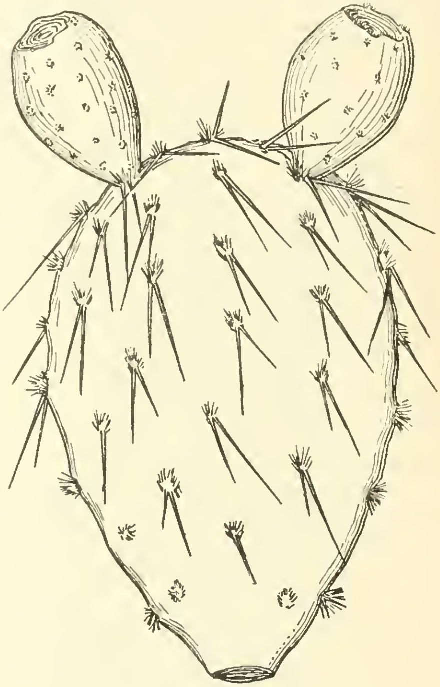


FIG. 13.—Prickly Pear.

Sorrel (*Oxalis corniculata*).—A well-known little plant, common to this section, called locally sheep sorrel or sour grass. It has a slightly sour taste and is supposed to possess tonic properties. Both cattle and sheep eat it.

Prairie Clover (*Kuhnistera*).—Stockmen here report that this species of clover, common throughout the prairie region, is to be found in many parts of central Texas. It contributes a considerable amount of good forage on the ranges and is much relished by stock.

Mesquite Bean (*Prosopis juliflora*) (fig. 14).—There are two well-known varieties of the small tree that produces this bean. In many of the counties of southwest Texas and along the Rio Grande the one bearing the screw bean or tornillo (*Prosopis pubescens*) is very common. The pods or beans are not only eaten by all classes of stock, but the Mexicans and Indians are known to use them as a food. The pods are spirally twisted, while those grown on the other variety are straight or curved. There are really two forms of this latter variety. In one the bark of the tree is much rougher than in the other, and the bean is bright yellow when ripe and much sweeter to the taste, the color of the other being reddish rather than yellow. "A thorny, leguminous shrub, growing in favored localities to a tree from 20 to 40 feet high, with a trunk sometimes reaching 2½ feet in diameter. It is widely distributed from Texas to southern California, through tropical America to Argentina. The leaves are very good browsing for horses and cattle. It bears two or more crops of beans a year, which are next to barley for fattening horses, cattle, sheep, and hogs. The leaves, pods, and bark are rich in tannin, and a gum similar to gum arabic exudes copiously from the trunk and branches. The wood is hard, strong, and durable, and takes a high polish. It is the most common tree of the mesas of the Southwest, and because of its many uses is an exceedingly valuable species." Experiments in a small way have been made here to preserve the beans for winter feeding with partial success only, because of a small weevil, that bores into them after they are gathered and renders them unfit for stock feed. One acre of land well covered with mesquite trees often produces not less than 100 bushels of the beans per annum. As, bushel for bushel, they are quite as valuable for feeding stock as cowpeas, it will be seen that for forage purposes the mesquite tree is an important factor in this section, where there are millions of them.

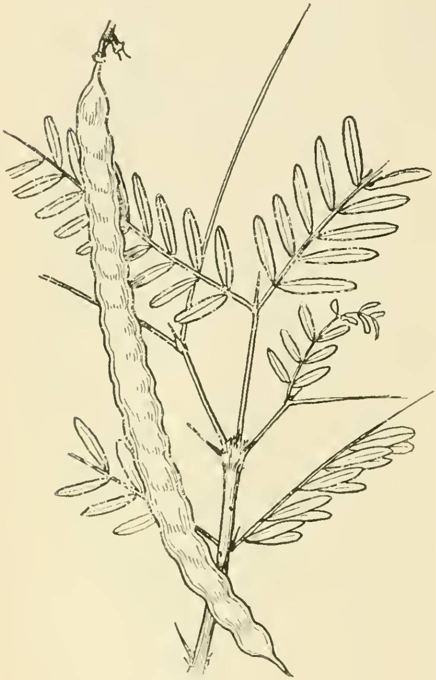


FIG. 14.—Mesquite Bean.

INDEX.

Page.

- *Actinella linearifolia* 20
- *Agropyron spicatum* 11
- Alfilaria 33
- Alkali saccatone 17
- *Allionia incarnata* 30
- *Amaranthus blitoides* 30
- *Ambliolepis setigera* 21
- *Ammannia coccinea* 31
- *Andropogon nutans* 12
  - *saccharoides torreyanus* 11
- Arctic grass 13
- Aristida arizonica 28
- *Aristida fasciculata* 23, 28
- Arizona millet 13
- *Artemisia ludoviciana* 27
  - *mexicana* 31
- Artichoke 34
- *Astragalus crassicarpus* 31
- *Atriplex canescens* 22
  - *obovatum* 21
  - *palmeri* 22
- Barnyard grass 17
- Beardless barnyard grass 18
- Beggar weed 22
- Bermuda 13
- Black grama 12, 16
- Blue grama 12
  - weed 34
- Bog rush 25
- *Bouteloua curtipendula* 12
  - *hirsuta* 12
  - *oligostachya* 12
- *Bromus unioloides* 13
- Browntop 29
- Buffalo grass 24
- *Bulbilis dactyloides* 13, 24
- Bur clover 35
  - grass 25
- Bushy blue-stem 12
  - knot weed 28
- Butterfly pea 27
- California clover 35
- Candy grass 29
- Careless weed 21
- *Carex* 25
  - *vulpinoides* 31
- *Cenchrus tribuloides* 25
- *Centaurea americana* 31
- *Chætochloa italica* 25
  - *macrostachya* 13
- Chaparral millet 18
- *Chenopodium album* 32
- *Chloris alba* 29
  - *cucullata* 29
- Chufa 32
- *Clematis drummondii* 32
  - *panicularia* 22
- *Clitoria mariana* 27
- Colorado grass 18
- Concho grass 18
- Cotton purslane 28
  - top 18
- Crab grass 26, 29
- Croton 32
- Crowfoot 29
- Curley mesquite 15
- *Cynodon dactylon* 13
- *Cyperus* 25

Page.

- *Cyperus erythrorhizos* 32
  - *esculentus* 32
- Dogtown grass 23
- Drop seed 19
- Dwarf broom weed 33
- *Elymus canadensis* 14
- *Ephedra nevadensis* 32
- *Eragrostis major* 29
  - *pilosa* 29
  - *secundiflora* 29
- *Eriochloa punctata* 14
- *Erodium cicutarium* 33
  - *moscatum* 33
- *Eurotia lanata* 33
- Everlasting grass 14
- Fall redtop 30
- Fall tallow weed 21
- Feather blue stem 11
  - crowfoot 29
  - sedge 11
- Fox sedge 31
- Galleta 16
- Grandpa's beard 32
- Grapevine mesquite 26
- *Grindelia squarrosa* 33
- Ground plum 31
- Gum weed 33
- Gunaninipil 30
- *Gutierrezia sarothræ microcephala*
- Hall's grass 29
- Hairy-flowered panic 29
- *Helianthus annuus* 33
  - *tuberosus* 34
- *Hilaria cenchroides* 15
  - *mutica* 16
- *Hoffmanseggia stricta* 34
- Hog nut 32
- Hurrah grass 18
- *Juncus* 25
- Knot grass 26
- *Kuhnistera* 35
- Lamb's quarter 32
- *Leptochloa dubia* 19
- *Lippia nodiflora* 34
- Love grass 29
- *Medicago maculata* 35
- Mesquite bean 36
- *Muhlenbergia arenicola* 29
  - *racemosa* 16
  - *tenuiflora* 25
- Needle grass 23
- Old witch grass 29
- *Opuntia engelmanni* 35
- *Oxalis corniculata* 35
- *Panicum bulbosum* 17
  - *capillare* 29
  - *ciliatissimum* 29
  - *crus-galli* 17
    - *muticum* 18
  - *fuscum* 29
  - *hallii* 29
  - *lachnanthum* 18
  - *obtusum* 26
  - *reticulatum* 18
  - *reverchoni* 18
  - *sanguinale* 26
  - *texanum* 18
  - *virgatum* 19

Page.
Paspalum distichum 26
    pubiflorum glabrum 19
Phaseolus helvolus 22
Plantago gnaphalioides 28
Polygonum ramosissimum 28
Portulaca oleracea 28
    pilosa 28
Prairie clover 36
    sage brush 27
Prickly pear 35
Prosopis juliflora 36
Purslane 28
Redroot sedge 32
Rescue grass 13
Rosin weed 33
Sage brush 31
Satin grass 25
Sedges 25
Side-oats grama 12
Sorrel 35
Sporobolus cryptandrus 19
    drummondii 30
Star thistle 31
Stink grass 29
Stolley vetch 20

Page.
Sunflower 33
Switch grass 19
Tallow weed 20
Texas crowfoot 19
Tickle grass 29
Triodia albescens 16
    seslerioides 30
Triple awn 28
Tumble weed 30
Uniola latifolia 27
Vicia leavenworthii 20
Water grass 19
    purslane 31
Western wheat grass 11
White sage 31
    top 16
Wild bean 22
    millet 25
    oats 27
    rye 14
    sedges 32
    timothy 16
    verbena 34
Winter fat 33
Woolly plantain 28

○

BULLETIN NO. 11. Agros. 30.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

NEW YORK BOTANICAL

STUDIES

ON

AMERICAN GRASSES.

I. A REVISION OF THE NORTH AMERICAN SPECIES OF CALAMAGROSTIS.
By THOMAS H. KEARNEY, JR.

II. DESCRIPTIONS OF NEW OR LITTLE-KNOWN GRASSES.
By F. LAMSON-SCRIBNER.

ISSUED JULY 20, 1898.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

BULLETIN No. 11. Agros. 30.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[**Grass and Forage Plant Investigations.**]

STUDIES
ON
AMERICAN GRASSES.

I. A REVISION OF THE NORTH AMERICAN SPECIES OF CALAMAGROSTIS.

By THOMAS H. KEARNEY, JR.

II. DESCRIPTIONS OF NEW OR LITTLE-KNOWN GRASSES.

By F. LAMSON-SCRIBNER.

ISSUED JULY 20, 1898.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

LETTER OF TRANSMITTAL

U. S. Department of Agriculture.
Division of Agrostology,
Washington, D. C., May 19, 1898.

Sir: I have the honor to transmit for your approval the manuscript of a continuation of Studies on American Grasses, embracing (1) "A revision of the North American species of *Calamagrostis*," by Mr. Thomas H. Kearney, jr., assistant agrostologist, and (2) "Descriptions of new or little-known grasses," by the Agrostologist, and respectfully recommend its publication as Bulletin No. 11 of this division. In the paper on the revision of the genus *Calamagrostis* only those species are included which occur in North America north of Mexico. All enumerated are natives, and of the thirty-eight species described thirty-three are believed to be endemic. Twenty-three species and varieties are described as new.

In the Rocky Mountain region there are twelve species, and while none are found in the Gulf States excepting in northern Georgia, they extend southward through Mexico, and the species multiply along the Andes of South America. In his enumeration of the species of *Calamagrostis* of the higher Andes Mr. H. L. Weddell characterizes sixty species. In North America the species are most abundant on the Pacific slope, where twenty-five species are known to occur.

The new species are fully described, and the synonymy and distribution of all the species included is fully presented. The keys of analysis have been made with much care, and can not fail to be found helpful in determining the species. Some of the species present so many forms that their limitation is difficult. In several cases it is impossible to draw sharp lines of separation, and this is especially true of *Calamagrostis canadensis* and *Calamagrostis langsdorffii*, also *Calamagrostis hyperborea* and *Calamagrostis inexpansa*. The descriptions and the data furnished relative to the distribution of the species are based upon specimens contained in the United States National Herbarium, and also those in the leading herbaria of the country.

That it has been possible to examine so large a series of specimens is due to the courtesy of those in charge of the several collections submitted for the purpose. Expression of thanks is here tendered to Mr. James Macoun, of the Geological and Natural History Survey of

Canada: Dr. B. L. Robinson, Gray Herbarium. Cambridge, Mass.; Dr. John K. Small, Columbia University; Mr. Stewardson Brown, of the Academy of Natural Sciences of Philadelphia; Dr. E. L. Greene, Catholic University; Mr. Theo. Holm, Washington, D. C.; Miss Alice Eastwood, California Academy of Sciences. Thanks are also due Dr. C. H. Merriam and Mr. Vernon Bailey for their kind assistance in determining the zonal limits of the species.

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.

I. A revision of the North American species of Calamagrostis. By Thomas H. Kearney, jr. 7
  Introduction 7
    Classification 7
    Geographical distribution 9
    Ecology 10
    Teratology 12
    Hybridism 13
    Species excluded 13
  North American species of Calamagrostis 13
    Analytical key to the species 13
II. Descriptions of new or little-known grasses. By F. Lamson-Scribner 42

ILLUSTRATIONS.

PLATES.

Page.

Plate I. Panicum linearifolium 60

II. Panicum equilaterale 60

III. Chætochloa latifolia 60

IV. Stipa williamsii 60

V. Sporobolus palmeri 60

VI. Zeugites pringlei 60

VII. Eragrostis viscosa 60

VIII. Poa juncifolia 60

IX. Poa hanseni 60

X. Poa atropurpurea 60

XI. Poa longepedunculata 60

XII. Agropyron elmeri 60

XIII. Agropyron brevifolium 60

XIV. Elymus capitatus 60

XV. Elymus saxicolus 60

XVI. Elymus ciliatus 60

XVII. Elymus simplex 60

FIGURES.

Fig. 1. Calamagrostis fasciculata 23

2. Panicum implicatum 43

3. Panicum baldwinii 44

4. Panicum wrightianum 45

5. Sporobolus thurberi 48

6. Sporobolus simplex 49

7. Agrostis paludosa 50

8. Trisetum argenteum 51

9. Trisetum wolfii 52

10. Trisetum muticum 53

11. Poa capillaris 54

12. Elymus hanseni 56

STUDIES ON AMERICAN GRASSES.

I. A REVISION OF THE NORTH AMERICAN SPECIES OF CALAMAGROSTIS.

By Thomas H. Kearney, Jr.

INTRODUCTION.

In North America, north of Mexico, thirty-eight species of *Calamagrostis* are known to occur, eleven of which are here published for the first time. All of these are native, no introduced species having as yet been reported. All belong to the section *Deyeuxia* Hack. (Clarion, as a genus), which is characterized by the usually hairy prolongation of the rachilla behind the palea. This prolongation is villous along its whole length to just below the apex,[1] except in *C. cinnoides*, which has the extension of the rachilla naked to just below the apex, where it bears a circle of long hairs, not unlike the pappus of some *Cichoriaceæ*. *C. cinnoides* is also unique among North American species in its pubescent caryopsis. All of our species, excepting *C. breweri*, have well-developed creeping rootstocks and at least some of the innovations extravaginal. The culms, usually simple, are sometimes branched in *C. langsdorffii*, *C. canadensis*, and *C. macouniana*.

CLASSIFICATION.

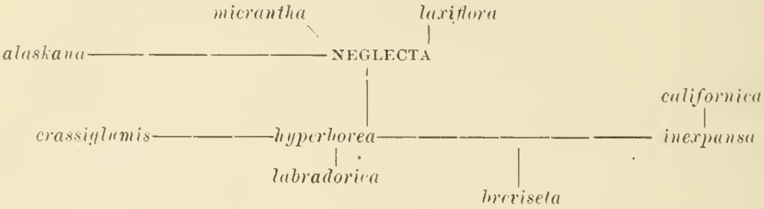
A satisfactory segregation of the North American species of *Calamagrostis* is rendered difficult by their great variability and the existence of a series of intergrading forms between many that are none the less too distinct in the typical form to admit of their being united. Thus from *C. canadensis* to *C. langsdorffii* a perfect gradation can be traced. From *C. hyperborea* to *C. neglecta*, on the one hand, and to *C. inexpansa* on the other, the transition is equally uninterrupted. The consequent impossibility of sharply defining some of the species has made it expedient to regard several of these intermediate forms as varieties of one of the two connected species, although rather arbitrary characters must be used for distinguishing them. This frequency of intergradation has made the construction of a serviceable key a task of more than ordinary difficulty.

---

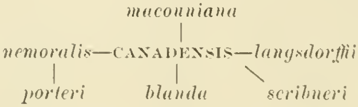
[1] Quite naked abnormally in one or two species.

As the sequence of species adopted in this revision is somewhat artificial, a brief discussion of their apparent natural relationships is here inserted. Most of the North American species can be arranged into five rather well-defined groups, represented, respectively, by *C. neglecta*, *C. canadensis*, *C. purpurascens*, *C. aleutica*, and *C. deschampsioides.*

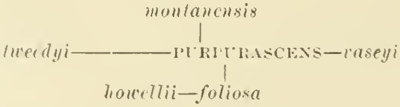
The first group is the most strongly European in its affinities. The following diagram indicates the relationships and possible genealogy of its members, the length of the connecting lines measuring to some extent the closeness of the relationship:


micrantha
laxiflora
alaskana
NEGLECTA
californica
crassiglumis
hyperborea
inexpansa
labradorica
breviseta

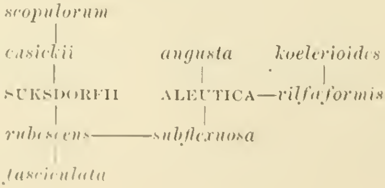
The second group is possibly derived from the *neglecta* type, although the probable line of descent is obscure. This group, like the first, is closely related to European and northern Asiatic types.


macouniana
nemoralis—CANADENSIS—langsdorffii
porteri
blanda
scribneri

The third group is perhaps derived from the *neglecta* type through *C. hyperborea*. It is significant that both *C. purpurascens* and *C. hyperborea* are found in North America and, elsewhere, only in Greenland, and are apparently the only species with such distribution. The *purpurascens* allies are related to the European *C. sylvatica*, but are otherwise more nearly an endemic type than are the two preceding groups.


montanensis
tweedyi
PURPURASCENS—vaseyi
howellii—foliosa

The fourth group contains two well-defined series of species, the first nearly related to *C. aleutica*, the second to *C. suksdorfii*. Through the second series this group is connected with *C. purpurascens* and its allies. Both types are purely endemic.


scopulorum
cusickii
angusta
koelerioides
SUKSDORFII
ALEUTICA—vilfaformis
rubescens
subflexuosa
fasciculata

The fifth group is of entirely problematical relationship. With the exception of *C. deschampsioides*, which ranges from the Pribilof Islands to Kamchatka, and is therefore more Asiatic than American, the species are endemic and are found only in the mountains of California.

breweri—lemmoni——deschampsioides———bolanderi.

Finally, *C. cinnoides* stands alone, an extremely isolated type without near relations.

GEOGRAPHICAL DISTRIBUTION.

The genus *Calamagrostis* contains approximately one hundred and fifty species, widely distributed over the globe, but in such a manner as to point strongly to a boreal origin, according to the generally accepted theory of migration during the glacial epoch, for outside of cold and cool temperate regions the species are found only on the higher mountains.

The development of numerous endemic forms in Australia and New Zealand is at first sight an obstacle to this theory of the origin of the genus, but the occurrence of scattered species on the mountains of India and the Malayan region deprives that objection of its force. The great number of species along the South American Cordilleras is perfectly in harmony with the known laws of plant distribution. The genus is at present most strongly developed in northern Europe and Siberia (twenty-five species), western North America (thirty-two species), the Andes region (seventy species), and Australia, including New Zealand and Tasmania (twenty species). There are eleven species in Atlantic North America, fifteen in Mexico and Central America, fifteen in the Himalayan-Malayan region, ten in eastern Asia, and fifteen in central and western Asia. With the exception of about ten species of the section *Epigeos* Koch, inhabiting the northern temperate regions of the Old World, all belong to the section *Deyeuxia*, which is often regarded as a separate genus, but is at best an artificial and unsatisfactory one.

Two of the thirty-eight North American species (*C. langsdorffii* and *C. neglecta*) occur also in northern Europe and Asia, two more (*C. purpurascens* and *C. hyperborea*) are found outside this continent only in Greenland, while a fifth (*C. deschampsioides*) is common to the Pribilof Islands and northeastern Asia. The remaining species are believed to be endemic. Considering the distribution of the genus in North America from a purely geographical standpoint we find ten species in the Atlantic-Appalachian region. Of these, three extend into the Southern States, one occurring in the undulating "middle" country and in the foothills, the other two only upon the highest mountains (above 1,800 meters). The genus is not represented in Florida, Mississippi, Louisiana, Arkansas, the Indian Territory, and Texas. Some half dozen species occur in the prairie districts and the region about the Great

Lakes. Four or five are found on the Great Plains east of the Rocky Mountains. In the Rocky Mountains proper there are twelve species, of which three extend as far south as New Mexico and Arizona. On the Pacific slope from southern Alaska to California there are twenty-five species in the mountains and along the coast. On the Alaskan peninsula and islands the genus is represented by seven species.

Turning to the biologically more important distribution by life zones, whose limits are fixed by sums total of effective temperature during a definite period, we find the species pretty equally divided between the Boreal and Transition zones—a distribution to be expected in a genus of northern origin. Only a single species (*C. purpurascens*) passes timber line northward and on the higher Rockies, and becomes truly Arctic-Alpine. Several, notably *C. breweri* in the Sierra Nevada, and *C. neglecta*, *C. langsdorffii*, and *C. hyperborea* northward, extend into the upper, or Hudsonian, belt of the boreal zone. in some cases probably nearly reaching timber line. Other species, for example, *C. cinnoides* in the Atlantic States, and *C. canadensis* and *C. hyperborea elongata* in the central prairie region, occur in country which is, broadly speaking, upper Sonoran. It is probable, however, that the modifying influence of a moist habitat accounts for such extensions, and that they are to be regarded as outposts of the Transition. None of the species can be regarded as of definitely Sonoran distribution.

The following is an approximate classification of the species by zones. It must be noted, however, that the most careful and thorough field work is necessary to make possible a complete and accurate definition of the zonal limits.

1. Arctic-Alpine and Boreal.—*C. purpurascens.*
2. Boreal.—*C. deschampsioides, lemmoni, breweri. foliosa* (?). *raseyi, tweedyi, aleutica, rubescens, breviseta, langsdorffii, canadensis acuminata, scribneri, alaskana, laxiflora. neglecta, micrantha, labradorica, hyperborea, crassiglumis.*
3. Boreal and Transition.—*C. suksdorfii, canadensis. hyperborea elongata, hyperborea americana.*
4. Transition.—*C. bolanderi, howellii, montanensis, rilfaeformis, koelerioides, angusta. subflexuosa, fasciculata, suksdorfii luxurians, porteri, nemoralis, blanda* (?) *macouniana, cusickii, scopulorum. cinnoides, inexpansa, Californica* (?).

ECOLOGY.

Plants are classed in respect to habitat and the resulting adaptations as hydrophytes (water plants), xerophytes (dry-soil plants), mesophytes (intermediate as to moisture requirement), and halophytes (salt-loving plants), the last class. however, being of decidedly less importance than the others. Nearly all the North American species of *Calamagrostis* belong to the first two classes. and the majority are hydrophytes. It is noteworthy, however, that nearly all the species, even those growing in the wettest soil. have characters that are generally supposed to belong rather to xerophile plants, such as narrow. erect, strongly involute leaf blades, short hairs or papillæ on the upper leaf surface, a thin coating of wax giving the plant a glaucous appearance, etc. This apparent anomaly is sometimes ascribed to the coldness of a wet soil, which diminishes the water-absorbing capacity of the root system and thus renders necessary the same contrivances to prevent too rapid transpiration that we see in plants inhabiting very dry soil. The smallest amount of xerophile habit is exhibited by *C. canadensis* and its nearest allies, especially when growing in shaded ground. On the other hand, the *purpurascens* group, with the exception of *C. tweedyi*, are "bunch grasses" with marked xerophile adaptation, conspicuously glaucous, having low, strict culms with tunicated bases in strong clumps from short, strong rootstocks, thickish, strongly involute, narrow leaf blades, etc.

An absolute ecological classification of the species is impracticable, for the same species may be under different conditions either hydrophile, mesophile, or xerophile. As has already been noted, this is frequently the case with species which toward the north inhabit dry, sunny situations, but further south take refuge from the increasing heat in moist woods or cold swamps. The following classification is based partly upon that of Warming.[1] A number of species are entirely omitted, no data as to their habit being available. Others are enumerated under more than one association class.

A. Hydrophytes.

1. Open marshes and wet meadows.—*C. canadensis, langsdorffii, scribneri, macouniana, neglecta, micrantha, laxiflora, hyperborea* (especially var. *elongata*), *inexpansa, crassiglumis, cinnoides, breviseta, bolanderi, deschampsioides, aleutica* (possibly halophile).
2. Sphagnum bogs.—*C. cinnoides* (sometimes), *alaskana* (?).
3. Low, moist woods and thickets (almost a mesophile association).—*C. canadensis* (sometimes), *langsdorffii* (sometimes), *blanda, neglecta borealis, suksdorfii* (normally xerophile).
4. Wet cliffs.—*C. hyperborea americana* (sometimes), *memoralis* (sometimes).

B. Xerophytes.

1. On or among rocks.—*C. purpurascens, vaseyi, howellii, scopulorum, labradorica, hyperborea* (sometimes).
2. Sandy or gravelly shores of lakes and rivers.—*C. rubescens, hyperborea* (sometimes), *hyperborea americana* (sometimes), *hyperborea elongata* (sometimes), *crassiglumis* (sometimes), *breviseta lacustris* (probably often hydrophile). It is doubtful whether this association is properly xerophile.
3. Sand hills.—*C. hyperborea americana* (sometimes).
4. Prairies and "bench lands."—*C. montanensis.*
5. Upland woods.—*C. porteri, memoralis, suksdorfii* (usually), *rubescens, purpurascens* (sometimes), *vilfaeformis, koelerioides.*

C. Halophytes.

Coast marshes.—*C. aleutica* (?).

In regard to abundance of individuals, the xerophile species are either copious or sparse, but usually scattered. (*C. suksdorfii* is an exception, for in the Cascade Mountains of Oregon and Washington it grows socially, sometimes covering the ground in the pine woods to the exclusion of other herbaceous vegetation.) Species of hydrophile habit, on the other hand, are often gregarious or even social. *C. canadensis*, for example, occasionally grows in nearly pure formations, covering open swamps and meadows with an almost unmixed growth.

---

[1] Lehrb. der oekolog. Pflanzengeogr. Deutsche Ausgabe, 1896.

TERATOLOGY.

Abnormal variation of different organs is not infrequent in *Calamagrostis*, especially in specimens growing at high altitudes and latitudes. Proliferation of the spikelets, the presence of a second (staminate) flower or even a third in the spikelets, and increase in the number of nerves in the glumes, are the most common deviations from normal characters. Such deviations are sometimes, but by no means always, due to disease. The following abnormalities in various organs were noted in the material examined in the preparation of this paper:

1. Three well-developed leafy branches from one of the culm nodes (*C. canadensis acuminata*).

2. Rudimentary sheath (?) at first node of rachis of panicle extended into a several-nerved bract about 5 mm. long, having the appearance and texture of a ligule (*C. langsdorffii*): into a bract about 4 mm. long, flat, ovate, 3-nerved (*C. canadensis*): into a bract 3 mm. long, somewhat spreading, subulate, chartaceous, possibly representing a blade (*C. macouniana*).

3. Panicle deeply lobed, with the appearance of a cluster of panicles (*C. neglecta borealis*).

4. Most of the spikelets 2-flowered, one 3-flowered. In the latter case the first flowering glume subtending an undeveloped caryopsis, the second a mature caryopsis, and the third empty, the rachilla being villous between the glumes and extending beyond the uppermost one (*C. aleutica*). Many of the spikelets in some panicles 2-flowered, the second flower staminate, with well-developed but somewhat smaller anthers, the rachilla bearded between the two flowering glumes and with the usual bearded prolongation (*C. subflexuosa*). A number of spikelets in one panicle 2-flowered, the second flower staminate, with a smaller but well-developed flowering glume and palea (*C. breviseta*). A second (staminate) flower with well-developed anthers, the rachilla villous between the flowering glumes and with the usual villous prolongation (*C. purpurascens*). In one (diseased) panicle each spikelet with a second (5-nerved) flowering glume slightly raised above the first (7-nerved), both glumes having dorsal awns of about equal length and neither having paleæ, the rachilla not extended beyond the second (*C. purpurascens*). A second (staminate) flower with well-developed anthers subtended by a narrow, short-awned glume (*C. cusickii*). A second flowering glume, bearing a long, nearly apical awn (*C. howellii*). A slender awn, equaling the flowering glume, borne at the summit of the prolongation of the rachilla (*C. bolanderi*).

5. First empty glume sometimes with a faint lateral nerve (*C. purpurascens*, etc.). In an abnormal, 2-flowered spikelet, the first empty glume cleft nearly to the middle, the lobe nearly as wide as the glume itself and with a second (lateral) nerve extending from the base of the glume to the apex of the lobe; the second glume cleft to the very base, the halves each 3-nerved and each nearly as large as the normal empty glume (*C. subflexuosa*). First empty glume frequently 3-nerved and the second 4-nerved, the fourth nerve faint and disappearing a short distance above the base (*C. aleutica*).

6. Flowering glume in one spikelet 6-nerved, the sixth nerve fainter than the rest and extending into a minute lateral tooth some distance below the apex of the glume (*C. purpurascens*). Teeth of the flowering-glume sometimes 0.5 mm. long (*C. purpurascens*).

7. Palea distinctly 3-nerved in one spikelet, the mid-nerve as prominent as the keels but not reaching the apex; in this case the prolongation of the rachilla unusually well developed (*C. breviseta*). Palea 5-nerved in one specimen, the nerves nearly equidistant and equally prominent to near the apex, but only the normal keels quite reaching the apex, the palea being strongly grooved only near the base and the strongly developed prolongation of the rachilla slightly lateral; in other spikelets the two outermost nerves anastomosing with the normal keel nerves and the central one disappearing below the middle of the palea (*C. aleutica*).

The frequency of two-flowered spikelets in this genus, often when the plant is apparently quite healthy, shows how slight the dividing line between the tribes *Agrostideæ* and *Aveneæ* may become.

HYBRIDISM.

To what extent the species of Calamagrostis hybridize with one another, if at all, can only be determined by actual experiment or the closest kind of field observation. It is not improbable that natural hybrids occur in the genus. Apparent crosses of *C. hyperborea* with *C. purpurascens*, *C. hyperborea* with *C. langsdorffii* and *C. canadensis* with *C. suksdorfii*, are represented in the United States National Herbarium.

SPECIES EXCLUDED.

Calamagrostis gigantea Nutt., Trans. Am. Phil. Soc. (II) **5**: 143 (1837) = *Calamovilfa longifolia* (Hook.) Scribn.

Calamagrostis andina Nutt. Pl. Gamb., Journ. Acad. Phila. (II) **1**: 187 (1848), not identifiable from the description, but certainly not a *Calamagrostis*.

Agrostis æquivalvis Trin., referred to *Deyeuxia* by Bentham on account of the minute usually hairy prolongation of its rachilla, is in all other respects an *Agrostis* and should be retained in that genus.

NORTH AMERICAN SPECIES OF CALAMAGROSTIS.

ANALYTICAL KEY TO THE SPECIES.

1. Awn strongly geniculate, exserted, callus hairs shorter than the flowering glume 2
1. Awn straight or nearly so, included, callus hairs not much shorter than the flowering glume 24
2. Awn much exceeding empty glumes 3
2. Awn shorter than or not much exceeding empty glumes 11
3. Panicle loosely flowered, rays spreading 4
3. Panicle densely flowered, rays appressed 8
4. Plants not cæspitose 5
4. Plants strongly cæspitose 6
5. Tall (5 to 14 dm. high), flowering glume strongly granular-scabrous .... 1. **C. bolanderi.**
5. Low (1.5 to 3 dm. high), flowering glume scabrous, but not granular .... 2. **C. deschampsioides.**
6. Leaves of innovations short, not nearly equaling the dark purple panicle, plant soft 7

6. Leaves of innovations long, often equaling or surpassing the whitish panicle, plant rather rigid .... 5. **C. howellii.**

7. Innovations extravaginal, rootstock strong, creeping, spikelets 4 to 5 mm. long .... 3. **C. lemmoni.**

7. Innovations intravaginal, rootstock none, spikelets 3.5 to 4 mm. long .... 4. **C. breweri.**

8. Strongly cæspitose, rather hard in texture, leaf-blades strongly involute 9

8. Not cæspitose, soft in texture, leaf-blades flat .... 9. **C. tweedyi.**

9. Innovation leaves very long (often surpassing the culm), filiform, not rigid, spikelets 8 to 10 mm. long .... 6. **C. foliosa.**

9. Innovation leaves short, not filiform, somewhat rigid, spikelets 4 to 8 mm. long. 10

10. Marcescent basal sheaths closely investing culm for $\frac{1}{6}$ to $\frac{1}{4}$ its length, panicle very dense, empty glumes more or less scabrous all over.. 7. **C. purpurascens.**

10. Marcescent basal sheaths much shorter, loose, panicle somewhat interrupted, empty glumes nearly glabrous except on keel .... 8. **C. vaseyi.**

11. Panicle open, loosely flowered, the rays wide-spreading 12

11. Panicle contracted, usually densely flowered, the rays erect or nearly so..... 13

12. Plant low (1.5 to 3 dm.), soft, panicle dark purple, few-flowered, empty glumes not sharply keeled .... 2. **C. deschampsioides.**

12. Plant tall, rather hard, panicle pale, empty glumes sharply keeled. 11. **C. aleutica.**

13. Spikelets strongly compressed, empty glumes sharply keeled 14

13. Spikelets not strongly compressed, empty glumes not strongly keeled 19

14. Plant low (not exceeding 5 dm.), leaves short, almost filiform, rigid, erect. Rocky Mountain species .... 10. **C. montanensis.**

14. Tall, leaves longer and wider. Pacific coast species 15

15. Panicle narrow and dense, spike-like, leaves all strongly involute 16

15. Panicle wider, not spike-like, usually loosely flowered, leaves often flat .... 11. **C. aleutica.**

16. Plant yellowish, sheaths not bearded at summit 17

16. Plant not yellowish, sheaths bearded at summit 18

17. Culms and sheaths strongly twisted toward base, panicle oblong-lanceolate, not interrupted, spikelets 5 to 5.5 mm. long .... 12. **C. vilfæformis.**

17. Culms and sheaths not or but slightly twisted, panicle oblong, much interrupted toward base, spikelets 4.5 to 5 mm. long .... 13. **C. kœlerioides.**

18. Panicle strict, spikelets about 6 mm. long .... 14. **C. angusta.**

18. Panicle usually somewhat flexuous, spikelets 4 to 5 mm. long. 15. **C. subflexuosa.**

19. More or less cæspitose, culms usually rather rigid, leaf-blades usually involute. Rocky Mountains and westward 20

19. Not cæspitose, culms not rigid, leaf-blades usually flat. Eastern species...... 22

20. Lower leaves in a dense tuft, short, rather rigid, strongly involute, spikelets about 4 mm. long .... 16. **C. fasciculata.**

20. Lower leaves rarely forming a dense tuft, usually elongated, not rigid....... 21

21. Panicle narrow, spiciform, usually red-purple .... 17. **C. rubescens.**

21. Panicle wider, rarely spiciform, usually pale-green .... 18. **C. suksdorfii.**

22. Sheaths rarely bearded at summit, panicle more or less tinged with lurid purple, empty glumes rather thick .... 19. **C. breviseta.**

22. Sheaths usually bearded, panicle not lurid purple, empty glumes thin 23

23. Spikelets 4 to 6 mm. long, callus hairs very sparse, the longer $\frac{1}{3}$ to $\frac{2}{3}$ as long as glume, palea equaling or very nearly equaling glume .... 20. **C. porteri.**

23. Spikelets 3.5 to 4 mm. long, callus hairs rather copious, the longer about $\frac{3}{4}$ as long as glume, palea considerably shorter than glume...... 21. **C. nemoralis.**

24. Panicle open, the lower rays wide-spreading, leaf-blades flat, callus hairs copious, nearly or quite equaling glume 25

24. Panicle more or less contracted 28

25. Spikelets 4 to 6 mm. long, empty glumes narrow, sharp-acuminate, awn stout, attached below middle, considerably exceeding glume.... 22. **C. langsdorffii.**

25. Spikelets 4 mm. long or less 26

26. Spikelets 3 to 4 mm. long, panicle usually loosely flowered 27

26. Spikelets 2 to 2.5 mm. long, panicle rather densely flowered. 25. **C. macouniana.**

27. Panicle branches conspicuously flexuous, awn attached near apex of glume and considerably exceeding it .... 23. **C. blanda.**

27. Panicle branches not conspicuously flexuous, awn attached usually near middle, equaling or slightly exceeding it .... 24. **C. canadensis.**

28. Leaf-blades flat or nearly so, panicle not spiciform 29

28. Leaf-blades strongly involute 33

29. Empty glumes not setaceous-pointed, prolongation of rachilla bearded its whole length, caryopsis glabrous 30

29. Empty glumes setaceous-pointed, prolongation of rachilla bearded only near summit, caryopsis pubescent especially at summit .... 30. **C. cinnoides.**

30. Callus hairs copious, ⅔ as long to longer than glume 31

30. Empty glumes narrow lanceolate, callus hairs sparse, ½ as long as glume or less 32

31. Not cæspitose, longer callus hairs not equaling glume .... 26. **C. scribneri.**

31. Strongly cæspitose, longer callus hairs considerably exceeding glume .... 27. **C. alaskana.**

32. Tall (9 to 12 dm.), sheaths bearded at summit .... 28. **C. cusickii.**

32. Usually low (not exceeding 8 dm.), sheaths not bearded .... 29. **C. scopulorum.**

33. Culms and usually almost filiform leaf-blades soft, not rigid, plant not cæspitose or not strongly so 34

33. Culms and (usually) wider leaf-blades hard, more or less rigid 36

34. Panicle dense, narrow, spike-like 35

34. Panicle loosely flowered, open, flexuous .... 31. **C. laxiflora.**

35. Spikelets 2.5 to 4 mm. long, empty glumes thin, acute sharp-acuminate .... 32. **C. neglecta.**

35. Spikelets 2 mm. long, empty glumes thickish, barely acute .. 33. **C. micrantha.**

36. Panicle elongated, not spike-like, rather loosely flowered, plant tall, not cæspitose or but slightly so 37

36. Panicle usually short, dense, spike-like, plant usually low, strongly cæspitose. 38

37. Ligule 4 to 6 mm. long, hairs of callus about equaling glume. 34. **C. inexpansa.**

37. Ligule 2 to 3 mm. long, hairs of callus ½ to ⅔ as long as glume. 35. **C. californica.**

38. Not exceeding 5 dm. in height, panicle slender, much interrupted toward base, awn not nearly equaling glume .... 36. **C. labradorica.**

38. Panicle thick, not conspicuously interrupted, awn nearly equaling to slightly exceeding the flowering glume 39

39. Taller (4 to 12 dm.), panicle larger (5 to 20 cm. long), empty glumes merely firm-membranous, oblong-lanceolate to ovate-lanceolate, short-acuminate .... 37. **C. hyperborea.**

39. Low (not exceeding 5 dm.), panicle small (4 to 6 cm. long), empty glumes almost coriaceous, broad ovate, acute .... 38. **C. crassiglumis.**

A. *Awn strongly geniculate, conspicuously exserted, callus hairs usually much shorter than the flowering glume.*

a. *Awn greatly exceeding the empty glumes.*

* *Panicle loosely flowered, branches spreading.*

† *Not cæspitose, panicle dark-brown purple.*

1. **Calamagrostis bolanderi** Thurb.; S. Wats. Bot. Calif. **2**: 280 (1880). *C. varia* Boland. in Thurb. l. c., not D. C. *Deyeuxia bolanderi* Scribn., Bull. Torr. Club. **10**: 8 (1883).

Northern California.

Type specimen collected in swamps, Mendocino County, by H. N. Bolander (No. 6471 in part).

SPECIMENS EXAMINED.—*California:* (Bolander 6471 in part); Mendocino (Pringle), 1892; (Kellogg and Harford 1092), 1868–69.

C. bolanderi is unique in the peculiar granular roughening of its flowering glumes. It has no near relative among the North American species.

2. **Calamagrostis deschampsioides** Trin. Ic. Gram. **3**: t. 354 (1836). *C. obtusata* Turcz., Bull. Soc. Nat. Mosc. **29**: Pt. 1, 26 (1856). *Deyeuxia deschampsioides* Scribn., Bull. Torr. Club **10**: 8 (1883).

Bering Sea region.

Type specimen collected in Kamchatka.

SPECIMENS EXAMINED.—*Pribilof Islands*: St. Paul Island (Merriam), 1891; St. Paul Island (Macoun 16224 (G. S. C.[1]), 1897. *Kamchatka*: Petropaulovski (C. Wright), 1853–56.

†† *Strongly cæspitose.*

‡ *Plant soft, leaves of innovations short, not nearly equaling the dark purple panicle.*

3. CALAMAGROSTIS LEMMONI Kearney, sp. n.[2]

Plants with slender, creeping rootstocks, numerous, short, erect, or ascending innovations, many slender erect culms 2.5 to 4.5 dm. high, and dark purple panicles. Culms often slightly geniculate, with a few short, loose, thin, marcescent sheaths at base; internodes 2, finally much exceeding their sheaths, the uppermost nearly twice as long as both sheath and blade. Sheaths loosely embracing the culm, thin, glabrous. Ligule 2 to 4 mm. long, thin, whitish, nearly glabrous, lower ones broadly truncate, upper ones narrowed from the base to the acute apex. Blades 2 to 20 cm. long, 1 mm. or less wide, strongly involute, especially toward the setaceous tip, somewhat spreading, flaccid, scabrous on the margins and upper surface. Panicle 4 to 8 cm. long, 1 to 2 cm. wide, oblong-lanceolate, acuminate, contracted, loosely few-flowered, erect, often somewhat flexuous: rachis slender, somewhat flexuous, glabrous or very nearly so, dark purple, its lowest internode 1.5 to 2 cm. long; branches spreading at a small angle (45 degrees or less) to nearly erect, slender, somewhat flexuous, dark purple, glabrous or the upper slightly hispidulous, secondary branches (usually) and shorter primary branches (often) 1-flowered, lower primary branches in 3's to 5's, the longest 2 to 3 cm. long. Spikelets 4 to 5 mm. long. Empty glumes lanceolate to ovate-lanceolate, acute or acutish, not strongly keeled, thin-membranous, dark red-purple, sparsely and minutely scabrous on the keel toward apex or entirely glabrous, equal or the first slightly longer. Flowering glume considerably (often nearly 1 mm.) shorter than the second empty glume (rarely nearly equaling it), oblong-ovate, broadly truncate, thin-membranous, with hyaline edges and tips, somewhat scabrous on the back, the nerves conspicuous, the lateral ones extended into slender, unequal terminal awns 0.3 mm. long or less; awn attached one-sixth above the base, much exceeding the glume, 5 to 6 mm. long, stout, minutely scabrous, strongly geniculate near the middle, the lower part somewhat twisted, the upper part divergent at an angle of 45 degrees, exserted, straight or slightly flexuous, dark purple. Palea about 1 mm. shorter than the flowering glume, ovate-oblong, truncate, entire or obscurely bidentate, glabrous. Anthers about 2 mm. long. Caryopsis nearly 2 mm. long. Callus hairs sparse, the dorsal ones very short, the lateral ones one-fourth to one-half as long as the flowering glume. Prolongation of the rachila copiously bearded, with its hairs exceeding the palea and sometimes equaling the flowering glume.

---

[1] Geological Survey of Canada.

[2] In the descriptions of the species the following points are to be noted: Length of innovation refers to length of branch and sheathes, excluding the blades. Number of internodes of the culm refers to those of conspicuous length above the base and below the inflorescense. Width of leaf-blade and of the panicle denotes the greatest width. Shape of panicle refers to the outline in the dried plant, fresh material of none of the species having been available. Length of spikelets means length of the longest empty glume, and excludes the awn. The awn is described from dried material, and does not, of course, exhibit exactly the same characters as in the fresh or living state.

In giving the geographical range of the species the typical form alone is included, that of the several varieties being separately stated. Data as to localities, altitude, and latitude are taken for the most part from the collectors' labels, without attempt at verification.

Type specimen in the United States National Herbarium, collected in California by J. G. Lemmon, in 1875.

Intermediate between *C. deschampsioides* and *C. breweri*. From the former it differs in its more cæspitose habit, culms taller; ligule usually longer; panicle more contracted; spikelets more numerous and smaller; glumes narrower; flowering glume usually considerably shorter than the empty glumes and conspicuously awn-toothed; awn longer and attached nearer the base, palea shorter, anthers smaller, callus hairs usually shorter, and prolongation of the rachilla longer and with much longer hairs. From *C. breweri* it is distinguished by its creeping rootstock, innovations extravaginal, leaf-blades longer, panicle larger, contracted, with less divergent branches, spikelets larger and more numerous, flowering glume usually considerably shorter than the empty glumes, awn usually longer, and palea considerably shorter than the flowering glume.

4. **Calamagrostis breweri** Thurb.; S. Wats. Bot. Calif. **2**: 280 (1880). *Deyeuxia breweri* Vasey Descr. Cat. Grasses U. S. 50 (1885).

Mountains of California.

Type specimen collected near Carsons Pass by W. H. Brewer (2128).

Specimens examined.—*Sierra Nevada Mountains:* Altitude 2,946 meters (Brewer 2128). *Upper Tuolumne River:* (Bolander 6098), 1867.

A peculiar species, with much the aspect of *Festuca ovina* L., distinguished from all other North American members of the genus by its strictly intravaginal innovations.

‡‡ *Plant rather stiff, leaves of innovations long, often equaling or surpassing the whitish panicle.*

5. **Calamagrostis howellii** Vasey; Coult. Bot. Gaz. **6**: 271 (1881). *Deyeuxia howellii* Vasey Descr. Cat. Grasses U. S. 51 (1885).

Washington and Oregon.

Type specimen collected in Oregon by T. J. Howell.

Specimens examined.—*Washington:* Larm River, West Klickitat County (Suksdorf 13), 1883. *Oregon:* Multonomah Falls (Bolander); Columbia River below the Cascades (Howell, 356), 1880; Sandy River (Henderson, 13).

A specimen from Washington, collected by Suksdorf, has the contracted but loosely-flowered panicle of the extreme form of *C. vaseyi*. In habit and other characters, however, it is not distinguishable from *C. howellii*.

** *Panicle densely flowered, branches appressed.*

† *Strongly cæspitose, rather hard in texture, leaf-blades strongly involute.*

6. **CALAMAGROSTIS FOLIOSA** Kearney, sp. n. *C. sylvatica longifolia* Vasey Monog. Grasses U. S., Contr. U. S. Herb. **3**:83 (1892), not *C. longifolia* Hook.

A somewhat glaucous species with slender rootstocks, numerous short, erect, or ascending innovations whose leaves often equal or surpass the culms, and dense spiciform panicles. Culms 2 to 4.5 dm. high, nearly erect, slender, somewhat flexuous; internodes usually 3, finally greatly exceeding their sheaths. Sheaths closely embracing the culm, slightly scabrous above. Ligule 4 to 5 mm. long, truncate rather firm, whitish, somewhat scabrous. Blades 1 to 3 dm. long, 1 mm. or usually much less in width, strongly involute and usually almost filiform, strongly scabrous on the margins and upper surface, glabrous beneath. Panicle 6 to 10 cm. long, 1 to 2 cm. wide, dense, spike-like, somewhat interrupted toward base, pale, purple, or greenish; rachis slender, somewhat scabrous above, its longest internode 1 to 2 cm. long; branches slender, hispidulous, erect and appressed, the lower primary branches mostly in 5's. Spikelets 8 to 10 mm. long. Empty glumes narrow-lanceolate, gradually attenuate from the base to the sharp-acuminate apex, thin, minutely scabrous, the first slightly longer. Flowering glume about 2 mm. shorter than the first empty one, lanceolate, acutish, minutely scabrous, of about the same texture as the empty glumes, the 4 lateral nerves extended into straight, erect, very slender awns of unequal length, the longest 1 to 2 mm.; dorsal awn attached about one-fifth above the base (but sometimes as high as one-third), 10 to 15 mm. long, slender, bent near the middle, the upper part much exserted and spreading at an angle of about 45 degrees. Palea four-fifths to five-sixths as long as the flowering glume (or occasionally nearly equaling it) considerably narrower, acute, with nerves somewhat excurrent, nearly glabrous. Callus hairs rather sparse, very unequal, the longer ones one-third to one-half (usually one-half) as long as the flowering glume. Prolongation of the rachilla with its rather copious hairs about equaling the palea.

California.

Type specimen in the United States National Herbarium, collected by H. N. Bolander (6470) in the Mattole district, Humboldt County.

C. foliosa is intermediate between *C. howellii* and *C. purpurascens*. From the former, its nearest ally, it differs in its contracted, dense panicle and usually larger spikelets. From *C. purpurascens* it is easily differentiated by its slender, somewhat flexuous culms, very long and almost filiform leaf-blades, considerably larger spikelets, much longer, more slender, less abruptly bent and nearly glabrous awn, prominent aristate teeth to the flowering glume and proportionately longer callus hairs.

7. **Calamagrostis purpurascens** R. Br.; Richards, App. Frankl. Journ., 731 (1823). *Deyeuxia purpurascens* Kunth, Rev. Gram. **1**: 77 (1835). *Calamagrostis sylvatica* A. Gray, Proc. Am. Acad. **6**: 80 (1866). *Deyeuxia sylvatica* Vasey, Descr. Cat. Grasses U. S., 51 (1885). *Calamagrostis sylvatica americana* Vasey. Monog. Grasses U. S., Contr. Nat. Herb. **3**: 83 (1892). *C. sylvatica purpurascens* Thurb.; Vasey, l. c.

East Greenland to Alaska, and southward along the higher mountains to South Dakota, Colorado, and California.

Type specimen collected in the Barren Lands between Point Lake and the Arctic Sea by Dr. Richardson.

SPECIMENS EXAMINED.—*Greenland:* Disco (Warming, Th. Fries, Holm); (Wetherill 4), 1891. *Arctic coast:* (Richardson, 59, 62, 67, Herb. Hook.). *Rocky Mountains:* Latitude 39 to 41 degrees (Hall and Harbour 621), 1862. *South Dakota:* Black Hills, altitude 1,670 to 1,824 meters (Rydberg 1130), 1892. *Assiniboia:* (Douglas). *Montana:* White Sulphur Springs, Belt Mountains, altitude 2,070 to 2,736 meters (Scribner 362), 1883; Spanish Creek, Gallatin County (Tweedy 1022); Baldy Peak near Bozeman (Rydberg 2224; Shear 468), 1895; Belt Pass (Rydberg 3313½), 1896; Barker, altitude 2,128 meters (Rydberg 3373), 1896; Black Hawk (Rydberg 3296), 1896; Spanish Peaks, altitude 2,432 meters (Rydberg 3071), 1896; Belt Mountains (R. S. Williams 596), 1888. *Wyoming:* Laramie Peak (A. Nelson 1627), 1895. *Colorado:* Denver (Coulter), 1873; (Wolf 398, 587), 1873; Pen Gulch (Vasey); Lake Ranch (G. H. French); Silver Plume, altitude 3,952 meters (Shear 691, 696; Rydberg 2470), 1895; Georgetown, altitude 2,512 meters (M. E. Jones 500), 1878; Georgetown (Shear 611), 1895; Clear Creek (Parry 365, 368), 1861; Pikes Peak (Canby, T. A. Williams 2170, 2188, 2188½), 1896; Maniton, El Paso County, altitude 3,010 meters (Clements 42), 1896; Colorado Mine (Rydberg 2380), 1895; Mount Princeton, altitude 3,314 meters

(Sheldon 607); Beaver Creek, Laramie County, altitude 3,344 meters (Pammel), 1896; Buenavista, Chaffee County, altitude 3,040 to 3,192 meters (Clements 309; Shear 1016), 1896. *Alberta:* Sheep Mountains (Macoun, 13113, G. S. C.); Morley (Macoun), 1885. *Idaho:* (Wheeler Expedition 798, in part),1871. *Utah:* (Ward) 1875. *Nevada:* Humboldt Mountains, altitude 3,040 meters (Watson 1291). *Alaska:* (McDonald), 1864; along Yukon River (Funston), 1893. *Northwest Territory:* Tagish Lake, latitude 62 (Dawson), 1887; Lewis River (Dawson), 1887; Fort Pelly Banks (Dawson), 1887; Bennetts Lake (Ogilvie), 1887. *British Columbia:* Donald (Macoun), 1885; Kicking Horse Lake (Macoun), 1885; Dease River (Dawson), 1887. *Washington:* Wenatchie region (Tweedy 650), 1883; Mount Stuart, altitude 2,280 to 2,432 meters (Sandberg and Leiberg 825), 1893. *Oregon:* Baker City (Nevius), 1873. *California:* Redwoods (Bolander); Mount Dana, altitude 3,748 meters (Bolander 5071).

C. purpurascens has been confused by some authors with the very distinct *C. sylvatica* (Schrad.) D. C. of Europe, which is a taller, less cæspitose grass with broad, flat, lax, leaf-blades; longer and looser panicle; and broader, less pointed, thinner, and nearly glabrous empty glumes.

CALAMAGROSTIS PURPURASCENS ARCTICA (Vasey) Kearney, n. comb. *C. Arctica* Vasey, Ill. N. Am. Grasses **2**: Pt. 2, No. 55 (1892).

Depauperate, perfectly smooth and glabrous up to the inflorescence. Culms ascending, 18 cm. or less in length. Leaf-blades short, the longest 7 cm. long, comparatively broad. Panicle 2 to 3 cm. long, barely 1 cm. wide. Spikelets about 5 mm. long. Awn short, about 7 mm. long.

Type specimen in the United States National Herbarium, collected on St. Paul Island, Pribilof Islands, by James M. Macoun (38), July 31, 1891.

8. **Calamagrostis vaseyi** Beal, Grasses N. Am. **2**: 344 (1896). *C. purpurascens* Vasey, Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 83 (1892), not R. Br.

Mountains of Washington and Oregon.[1]

Type specimen collected in the Cascade Mountains, Washington, by G. R. Vasey, in 1889.

SPECIMENS EXAMINED.—*Washington:* Cascade Mountains (G. R. Vasey), 1889; Goat Mountains (O. D. Allen 177), 1896; Skamania County (Suksdorf, 201, 909, 1025), 1886–1890; South Olympia Mountains, altitude 1,368 meters (Henderson 1855), 1890; (Brandegee 177), 1882. *Oregon:* Siskiyou Mountains (Howell), 1887.

Intermediate between *C. purpurascens* and *C. howellii*, the type specimens with shorter awns and denser panicles being nearer the former. From *C. purpurascens* it differs in being very strongly cæspitose from a hard, knotted rootstock, with less rigid and more slender culms; marcescent basal sheaths very short and less closely enveloping the culm; panicle usually looser, fewer flowered, broader, less colored, with longer, straighter, more slender, and less scabrous branches; thinner and smoother, less strongly keeled empty glumes; usually much longer and more slender awn attached higher; and longer callus hairs. From *C. howellii* it differs in its shorter, flatter, and more rigid leaf-blades; and contracted, usually purplish panicle. The spikelets are much like those of the European *C. sylvatica*, but in other respects the plant is quite different.

†† *Not cæspitose, soft in texture, leaf-blades flat.*

9. **Calamagrostis tweedyi** Scribner; Vasey, Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 83 (1892). *Deyeuxia tweedyi* Scribn., Bull. Torr. Club **10**: 64 (1883).

Type specimen collected in the Cascade Mountains, Washington, by Frank Tweedy.

SPECIMENS EXAMINED.—*Washington:* Cascade Mountains (G. R. Vasey), 1889.

A unique species with no near ally.

---

[1] Northward to Alaska according to Beal, but this is probably a mistake.

b. Awn shorter than or not much exceeding the empty glumes.

** Spikelets strongly compressed, empty glumes sharply keeled.*

† Plant low, leaf-blades almost filiform—Rocky Mountain species.

10. **Calamagrostis montanensis** Scribn.; Vasey, Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 82 (1892). *Deyeuxia montanensis* Scribn., Proc. Soc. Prom. Agric. (1884) 52 (1885).

Saskatchewan and Alberta to South Dakota and Wyoming.

Type specimen collected on dry "bench lands" east of Helena, Mont,, by F. Lamson-Scribner, July 2, 1883.

Specimens examined.—*Saskatchewan:* (Bourgeau), 1858. *Assiniboia:* Salt Lake (Macoun 101), 1879; Moose Jaw (Macoun 13102, 13110, G. S. C.), 1896; Chaplin (Macoun 13103, H. G. S. C.), 1896; Cypress Hills (Macoun, 13099, G. S. C.), 1895. *North Dakota:* Billings, Medora County, altitude 668 meters (Brannon 130), 1896. *South Dakota:* Aurora County, altitude 456 meters (Wilcox 744), 1892–93; Rondell, common from Aberdeen to Redfield (Griffiths 129), 1896. *Montana:* Sixteen Mile Creek, near Helena, altitude 1,520 meters (Scribner 363), 1883; Grasshopper Valley (Watson 450), 1880; Columbia Falls (R. S. Williams 846), 1894. *Wyoming:* Carbon, altitude 2,064 meters (Britton), 1882; Sheridan County (Buffum, Nelson 5091), 1892. *Alberta:* Pot Hole Creek (Macoun 13098, G. S. C.), 1895; Crow Nest Pass (Dawson 17426), 1883.

The Wyoming specimens have unusually small spikelets (4 mm. long), and in Nelson's plant the palea exceeds the flowering glume by 0.5 mm.

†† Plant tall, leaf-blades not filiform—Pacific coast species.

11. **Calamagrostis aleutica** Bong. Veg. Sitcha, Mem. Acad. St. Petersb. (VI) **2**: 171 (1832). *Deyeuxia nutkaensis* Presl Rel. Haenk. **1**: 250 (1828)?. *Calamagrostis nutkaensis* Steud. Syn. Pl. Gram., 190 (1855)?. *Deyeuxia aleutica* Munro; Hook. f., Trans. Linn. Soc. **23**: 345 (1862). *Calamagrostis albicans* Buckl., Proc. Acad. Phila. (1862) 92 (1863). *C. pallida* Nutt., A. Gray, Proc. Acad. Phila. (1862) 334 (1863). *Deyeuxia breviaristata* Vasey, Bull. Torr. Club **15**: 48 (1888).

Along the Pacific coast, Unalaska to central California.

Type specimen collected in Unalaska by Chamisso and Eschscholtz.

Specimens examined.—*Unalaska* (Mertens); (Harrington), 1871–72; (Kellogg 111), 1867. *Alaska:* (Applegate); (Howell); Sitka (Barclay). *British Columbia:* Vancouver Island (J. G. Swan); Barclay Sound, Vancouver Island (Macoun 1734 H. G. S. C.), 1887, type of *Deyeuxia breviaristata* Vasey. *Washington:* (Henderson 2154), 1892. *Oregon:* "Columbia alluvium" (Nuttall), type of *C. albicans* Buckl. and *C. pallida* Nutt.; Waldo (Howell), 1882; (E. Hall 623), 1871. *California:* Oakland, Marin County (Bolander 2274, 6084), 1866; Mendocino (Pringle), 1882; Santa Cruz (Anderson).

CALAMAGROSTIS ALEUTICA PATENS Kearney, var. n.

Culm somewhat geniculate; leaf-blades flat; panicle ovate, about 2 dm. long and 1 dm. wide, open, the branches wide spreading, the primary branches finally horizontal; spikelets about 5 mm. long; awn attached one-sixth to one-fifth above the base of the glume, exceeding the glume by about 1 mm., strongly geniculate, the lower part rather strongly twisted; prolongation of the rachilla with its hairs considerably exceeding those of the palea.

Type specimen in the Gray Herbarium of Harvard University, collected near Mendocino, Cal., probably by H. N. Bolander.

12. **Calamagrostis vilfæformis** Kearney, new name. *C. densa* Vasey; Coult. Bot. Gaz. **16**: 147 (1891), not *Deyeuxia densa* Benth. *C. koelerioides densa* Beal Grasses N. Am. **2**: 345 (1896).

Southern California.

Type specimen in the United States National Herbarium, collected near Julian, San Diego County, by C. R. Orcutt, in 1889.

SPECIMENS EXAMINED.—Julian, San Diego County (Orcutt), 1889; near Potrero Valley, San Diego County (Orcutt), 1890; Jamuel Valley, San Diego County (Orcutt), 1890.

The specimens are all immature, with the bases of the panicles still subtended by the uppermost sheaths, and only a few of the spikelets barely in anthesis.

13. **Calamagrostis koelerioides** Vasey; Coult. Bot. Gaz. **16**: 147 (1891).

Southern California.

Type specimen in the United States National Herbarium, collected near Julian, San Diego County, by C. R. Orcutt, 1889–90.

Nearly related to *C. vilfaeformis*, but readily distinguished by its stricter, more slender, and slightly or not at all twisted culms; slightly or not at all twisted sheaths; shorter, narrower, and more strongly involute leaf-blades; smaller, oblong, obtuse, interrupted panicles with shorter branches; somewhat smaller spikelets; broader and less pointed empty glumes; shorter flowering glume; awn attached somewhat higher; hairs of callus somewhat longer, and palea proportionately longer. The specimens are much more mature than those of *C. vilfaeformis*, yet they exhibit smaller dimensions in almost every part.

14. **CALAMAGROSTIS ANGUSTA** (Vasey) Kearney, sp. n. *C. aleutica angusta* Vasey Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 80 (1892).

Rather tall and strict, of hard texture, with strong creeping rootstocks, erect rather long innovations, few culms, and narrow, spike-like, densely flowered panicles. Culms 7 to 11 dm. high, rather slender, erect, and strict (occasionally slightly geniculate below), with a few short, rather loose, marcescent sheaths at base, occasionally slightly twisted below; internodes 4, all but the lowest finally greatly exceeding their sheaths, the uppermost about twice as long. Sheaths rather closely embracing the culms, scabrous, especially toward summit, bearded at junction with the blade (except the uppermost), sometimes very sparsely pubescent toward summit, thickish and rather rigid. Ligule about 4 mm. long, truncate or rounded at the broad apex, thin, minutely scabrous. Blades (of innovations) 5 to 25 (mostly about 15) cm. long, erect, cauline spreading, the uppermost 5 cm. or less long, all 2 to 4 mm. wide, strongly involute at least toward the filiform tip, thickish, usually rather rigid, scabrous on the nerves and margins; minutely pubescent above. Panicle 11 to 17 (mostly 15) cm. long, 1 to 1.5 cm. wide, linear-lanceolate in outline, acuminate, erect, strict, occasionally somewhat interrupted toward base, straw-color, faintly tinged with red purple; rachis scabrous especially toward apex, its lowest internode 2 to 3 cm. long; branches short, appressed, densely flowered, somewhat flexuous, slender, scabrous-pubescent, the lower primary branches mostly in 3's, the longest 2.5 to 5 cm. long. Spikelets nearly 6 mm. long. Empty glumes narrow-lanceolate, sharp-acuminate, rather sharply keeled, minutely scabrous, usually minutely hispidulous on the keel, faintly tinged with purple along the nerves, the first slightly longer. Flowering glume slightly to 1 mm. shorter than the second empty glume, oblong-lanceolate, narrowly truncate, minutely 4-dentate, minutely and densely scabrous on the back; awn attached near the base (one-sixth above or lower), about 3 mm. long, nearly equaling the glume, stout, minutely scabrous, bent somewhat above the middle (sometimes one-third below the apex), the lower part loosely twisted, the upper part divergent at an angle of about 15 degrees, exserted. Palea somewhat exceeding the flowering glume, narrow-lanceolate, narrowed to the obtuse apex, minutely to rather distinctly bidentate, minutely scabrous on the keels. Anthers about 3 mm. long. Callus hairs rather sparse, in two lateral tufts (none dorsal), the longer, two fifths to one-half as long as the flowering glume. Prolongation of the rachilla with its hairs about three-fifths as long as the palea.

Type specimen collected at Santa Cruz, Cal., by Dr. C. L. Anderson, 1891–92.

Differs from *C. aleutica* in its smaller size; more slender habit; culms and sheaths very slightly or not at all twisted; ligule usually longer; sheaths bearded at junction with the blades; blades shorter and much narrower, more strongly involute; panicle narrow, spike-like, densely flowered; spikelets less compressed; empty glumes less strongly keeled and thinner; flowering glume shorter; awn longer and attached lower; callus hairs fewer and altogether lateral, and prolongation of the rachilla with its hairs always exceeding those of the callus.

15. **CALAMAGROSTIS SUBFLEXUOSA** Kearney, sp. n.

Cæspitose, of rather soft texture, pale but not glaucous, with slender, creeping rootstocks, erect or ascending innovations 1 dm. or less high, rather slender culms very leafy toward base, and narrow, densely flowered panicles. Culms 5 to 10 dm. high, erect, usually slightly compressed toward base, somewhat closely enveloped toward base by the rather long, thin, often somewhat twisted marcescent sheaths; internodes 3 to 4 (usually 4) finally much exceeding their sheaths, the uppermost considerably exceeding both sheath and blade. Sheaths rather loose, the lower ones obscurely pubescent at summit, elsewhere glabrous, or very nearly so. Ligule 2 to 4 mm. long, slightly narrowed to the truncate apex, thin. Blades (lower and of innovations) 1 to 2.5 dm. long; (uppermost), .5 to 1 dm. long, all 2 to 4 mm. wide, strongly involute, slightly scabrous on the margins and nerves, the lower erect, the upper more or less spreading. Panicle 1 to 2 dm. long, 1 to 2 cm. wide, oblong lanceolate, acutish or occasionally acuminate, strongly contracted, almost spiciform, many-flowered, erect, usually somewhat flexuous, often somewhat interrupted, or even slightly lobed, pale brown tinged with pale purple, rachis rather slender, minutely scabrous especially toward apex, its lowest internode 2 to 3.5 cm. long; branches slender, somewhat flexuous, minutely hispidulous, densely flowered, erect or nearly so, the lower primary branches in 4's to 6's, the longest 2.5 to 6 (mostly 5) cm. long. Spikelets 4 to 5 mm. long. Empty glumes lanceolate, acute or short acuminate, rather sharply keeled, firm membranous, minutely scabrous on the keels, elsewhere glabrous, tinged with red-purple, equal or the first slightly longer. Flowering glume, equaling or slightly shorter than the second empty glume, oblong ovate, broadly truncate, minutely to rather conspicuously 4-dentate, thin membranous, rather firm, somewhat scabrous on the back, sometimes tinged with purple; awn attached one-sixth to one-fifth above the base, slightly shorter than to slightly exceeding the glume, stout, minutely scabrous, bent somewhat above the middle, the lower part somewhat twisted, the upper part divergent at an angle of 45 degrees or less, usually somewhat exserted. Palea equaling or slightly exceeding the flowering glume, oblong lanceolate, narrowly truncate, minutely bidentate, thin membranous, minutely scabrous on the keels. Anthers about 2 mm. long. Callus hairs sparse, rather stiff, the longer (lateral) ones two-fifths to three-fifths as long as the flowering glume, dorsal ones much shorter. Prolongation of the rachilla rather sparsely bearded, with its hairs considerably exceeding the longer callus hairs, sometimes only one-fifth shorter than the palea.

Type specimen in the United States National Herbarium collected at Oakland, Cal., by H. N. Bolander (2274).

Apparently intermediate between *C. suksdorfii* and *C. augusta*. From *C. suksdorfii* it differs in its less rigid and wiry culms; long, narrow, dense, not lucid, brownish-purple panicle; strongly keeled empty glumes; flowering glume nearly or quite equaling the empty ones; shorter awn; usually longer callus hairs and larger anthers. From *C. augusta* it is distinguished by its less rigid habit, more flexuous panicle with longer branches, smaller spikelets, less scabrous and usually longer flowering glume, and smaller anthers.

* * *Spikelets not strongly compressed, empty glumes not strongly keeled.*

† *Cæspitose, culms usually somewhat rigid, leaf-blades usually involute—Rocky Mountains and westward.*

16. **CALAMAGROSTIS FASCICULATA** Kearney, sp. n. (Fig. 1.)

Somewhat glaucous, with long, slender, scaly, creeping rootstocks, often with ascending leafy stolons, numerous very short, erect innovations forming a dense tuft, and slender culms very leafy toward base. Culms 6 to 9 dm. long, usually geniculate or even slightly arcuate near base, then erect and rather strict; internodes 3 to 4 (mostly 4), all but the lowest finally exceeding their sheaths, the highest ultimately much more than twice as long as both sheath and blade. Sheaths minutely scabrous, the lower ones bearded at junction with the blade, usually purplish. Ligule 4 to 5 mm. long, pointed, very thin. Blades (of innovations) 10 to 20 (mostly 15) cm. long, 2 to 3 mm. wide; uppermost cauline 4 to 7 cm. long, about 2 mm. wide; all strongly involute, erect, rather rigid, minutely and densely scabrous on the nerves and margins. Panicle 5 to 10 cm. long, about 1 cm. wide, lanceolate, acute, contracted, much interrupted, dull brown tinged with red-purple; rachis slender, minutely scabrous, its lowest internode 5 to 15 mm. long; branches short, appressed, densely flowered, scabrous-pubescent, the lower primary branches in 3's or 5's, the longest about 15 mm. long. Spikelets about 4 mm. long; empty glumes oblong-lanceolate or lanceolate, acutish to sharp-acuminate, thin-membranous, scabrous on the back, especially along the keel, nearly equal or the first somewhat longer. Flowering glume equaling or somewhat shorter than the empty glumes, oblong-ovate, broadly truncate, minutely 4-dentate, thin, scabrous on the back; awn attached about one-fourth above the base, usually conspicuously exceeding the glume (sometimes merely equaling it), stout, bent about one-third below its apex, the lower part twisted, the upper part divergent at an angle of about 45 degrees, exserted, usually dark purple. Palea nearly equaling to slightly exceeding the flowering glume, oblong-lanceolate, narrowly truncate, almost entire or minutely bidentate at apex, minutely roughened and often purplish along the keels. Callus hairs very sparse, mostly lateral, the longer two-fifths to two-thirds as long as the flowering glume. Prolongation of the rachilla sparsely bearded, with its hairs one-sixth to one-third shorter than the palea (or sometimes minute with a few very short hairs).

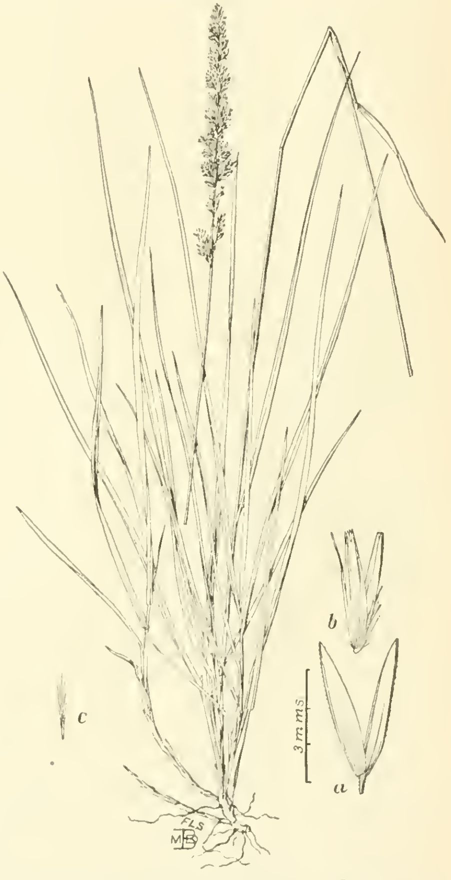


Fig. 1.—*Calamagrostis fasciculata* Kearney: *a*, empty glumes; *b*, floret; *c*, rudiment or prolongation of rachilla.

California.

Type specimen in the United States National Herbarium, collected on the plains of Mendocino by C. G. Pringle, August, 1882.

Specimens examined.—Mendocino (Pringle), 1882; Mount Tamalpais, Marin County (Congdon 36a), 1889.

Nearly related to *C. suksdorfii*, differing in its strict habit; innovations forming a close tuft at the base of the culms (which gives the plant a characteristic appearance); leaf-blades rigid and strongly involute; panicle dull brown; empty glumes more scabrous; awn bent nearer its apex; palea equaling or slightly exceeding the flowering glumes; and callus hairs longer.

17. **Calamagrostis rubescens** Buckl., Proc. Phila. Acad. (1862), 92 (1863). *Deyeuxia varia* Scribn., Bull. Torr. Club **9**: 45 (1882), not Kunth. *D. rubescens* Scribn., Bull. Torr. Club. **10**: 8 (1883).

British Columbia and Alberta to California.

Type specimen in the herbarium of the Philadelphia Academy of Sciences, collected in Oregon by Nuttall.

Specimens examined.—*Alberta:* Sheep Mountains, altitude 1,976 meters (Macoun 13113 H. G. S. C.), 1895; Banff (Canby 17), 1895. *British Columbia:* Donald (Macoun 17435 H. G. S. C.), 1885; Deer Park, Lower Arrow Lake (Macoun 17134 H. G. S. C.), 1890; Ainsworth, Kootenai Lake, altitude 848 meters (Macoun 17136 H. G. S. C.), 1890; Kicking Horse Lake, altitude 1,520 meters (Macoun 22), 1890. *Washington:* Cascade Mountains (G. R. Vasey), 1889; (Henderson 2152), 1892. *Oregon:* (Nuttall). *California:* Head waters Sacramento River, altitude 1,520 meters (Pringle), 1881 (not typical); Santa Cruz (Anderson), 1886; Mount Tamalpais (Blankenship 28), 1891.

Nearly related to *C. suksdorfii* and sometimes rather difficult to distinguish from that species. The long, narrow, spike-like, usually red-purple panicle and usually glabrous or nearly glabrous flowering glume are the most obvious characters. The California specimens with greenish panicles are less typical.

18. **Calamagrostis suksdorfii** Scribn.; Vasey Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 82 (1892). *Deyeuxia suksdorfii* Scribn.; Vasey Descr. Cat. Grasses U. S. 51 (1885).

Wyoming and Montana to British Columbia and central California.

Type specimen collected in the canyon of Smith River, Montana, altitude 2,432 meters, by F. Lamson-Scribner in 1883.

Specimens examined.—*Montana:* Smith River (Scribner 361), 1883; (R. S. Williams 1050), 1894; Glendive (E. A. Ross), 1892; Baldy Peak, Bozeman (Rydberg 2230), 1895; Dry Fork Belt Creek, altitude 1,216 meters (Rydberg 3346, 3359), 1896; Barker, altitude 1,824 meters (Rydberg 3384), 1896. *Wyoming:* Mammoth Hot Springs, Yellowstone Park (Mulford), 1892. *Northwest Territory:* Louis Plain (Macoun 39), 1883. *Idaho:* Lake Pend d'Oreille, Kootenai County (Sandberg 769), 1892; Lake Tesemini, Kootenai County (Sandberg 682), 1892; Beaver Canyon (Rydberg 2325, 2332; Shear 575, 578), 1895; Latah County (Elmer 335). *Alberta:* Banff (Macoun 11455 H. G. S. C.), 1891. *British Columbia:* Ainsworth, Kootenai Lake, altitude 848 meters (Macoun), 1890; Fraser River (Fletcher 52), 1883; Kootenai Pass (Dawson 17138 H. G. S. C.), 1883. *Washington:* Falcon Valley (Suksdorf 26, 607), 1882–1885; Spokane County (Suksdorf 92), 1881; Spokane (Piper 1918), 1894; Pullman (Piper 1919), 1894; Big Klickitat River, Cascade Mountains (Henderson 2150, 2151, 2153, 2155), 1892. *Oregon:* (Howell 195), 1886; Union County (Cusick 1150, 1317), 1881–1886. *California:* (Kellogg and Harford 1089).

CALAMAGROSTIS SUKSDORFII LUXURIANS Kearney, var. n.

A large form, resembling *C. cusickii* in size and habit. Culms stout, 10 to 13 dm. long, usually of softer texture than in the type; leaf-blades usually laxer and less involute, sometimes flat; panicle large, 1 to 2 dm. long, 2 to 3 cm. wide, oblong-lanceolate, often more loosely flowered than in the type, the longest primary branch 3 to 7 cm. long; spikelets usually 5 (sometimes only 4) mm. long; flowering glume one-fourth to one-fifth shorter than the shorter empty glume.

British Columbia, Washington, and Idaho.

Type specimen in the United States National Herbarium, collected at Farmington Landing, Lake Cœur d'Alene, Idaho, by Sandberg, Heller, and McDougal (630), 1892.

Specimens examined.—*Idaho:* Farmington Landing (Sandberg, 630), 1892; Palouse country and Lake Cœur d'Alene (G. B. Aiton 41), 1892; Latah County (Piper 1761), 1893; Cœur d'Alene Mission (Henderson 2832), 1894; Lake Waha, Nez Perces County, altitude 608 to 1,064 meters (Heller), 1896. *British Columbia:* Sicamous (Macoun 37, 17439 H. G. S. C.), 1889; Revelstoke (Macoun 24, 17437 H. G. S. C.), 1890. *Washington:* Cascade Mountains (G. R. Vasey), 1889; (Brandegee 1171), 1883; Peshastin, altitude 608 to 912 meters (Sandberg and Leiberg), 1893.

††*Not cæspitose, or but slightly so; culms not rigid, leaf-blades usually nearly flat—Eastern species.*

19. **Calamagrostis breviseta** (A. Gray) Scribn., Mem. Torr. Club **5**: 41 (1894). *C. sylvatica breviseta* A. Gray, Man., 582 (1848). *C. pickeringii* A. Gray, Man., ed. 2 547 (1856). *Deyeuxia pickeringii* Vasey, Descr. Cat. Grasses U. S., 51 (1885).

Nova Scotia and Cape Breton to the mountains of New England and northern New York.

Type specimen collected on the alpine tops of the White Mountains, New Hampshire.

Specimens examined.—*Cape Breton:* Arichat, Isle Madame (J. A. Allen 17), 1882. *Nova Scotia:* Louisbourg (Macoun 41, 17423 H. G. S. C.), 1883. *Vermont:* (Pringle) 1877. *New Hampshire:* White Mountains (Oakes, Tuckerman); Echo Lake, Franconia (Chickering); Mount Monroe (C. E. Faxon 16, 17), 1877; Mount Washington (C. E. Faxon), 1885. *Massachusetts:* Naggett's Pond, Andover (J. Robinson), 1879. *New York:* Avalanche Lake (Torrey?).

The Cape Breton and Nova Scotia specimens are more leafy and have a narrower, denser, stricter, darker-colored panicle than the White Mountain plant.

CALAMAGROSTIS BREVISETA DEBILIS Kearney, var. n.

Of softer texture: culms sometimes only 2 dm. high, very slender, less rigid, the uppermost internodes much elongated, usually twice as long as both sheath and blade; leaf-blades thinner and rather lax; panicle small (mostly 4 to 10 cm. long, about 1 cm wide), contracted, almost spiciform, somewhat flexuous; empty glumes narrower and somewhat thinner.

Newfoundland to Massachusetts.

Type specimen in the United States National Herbarium collected on the banks of the Exploits River, near the mouth of Badger Brook, Newfoundland, by B. L. Robinson and H. Schrenk (205), August 13, 1894.

Specimens examined.—*Newfoundland:* Exploits River (Robinson and Schrenk 205), 1894; Chimney Cove (Waghorne 8), 1895; Grand Lake (Waghorne 41, 42), 1896. *New Hampshire:* Ethans Pond, Mount Willey (Pringle, E. Faxon), 1877–79. *Massachusetts:* Essex County (Conant), 1880.

CALAMAGROSTIS BREVISETA LACUSTRIS Kearney, var. n. *C. lapponica* A. Gray, Proc. Am. Acad., **6**: 78 (1862) in part.

Sometimes stoloniferous; rootstock stouter; culms usually taller (5 to 10 dm. high); sheaths occasionally somewhat bearded at summit; leaf-blades usually longer and somewhat involute; panicle often longer (maximum length 1.5 dm.); empty glumes usually more scabrous on the keel; flowering glume often somewhat thinner; awn attached one-fourth to one-third above the base; palea noticeably shorter than the flowering glume, almost hyaline; callus-hairs more copious, the longer three-fourths to six-sevenths as long as the flowering glume; prolongation of the rachilla with its hairs slightly shorter than to equaling the flowering glume.

Mountains of New England; near the Great Lakes, Ontario to Minnesota.

Type specimen in the United States National Herbarium collected at Fond du Lac, Minn., by F. F. Wood, July 23, 1889.

SPECIMENS EXAMINED.—*New Hampshire:* Mount Willard (C. E. Faxon 9), 1875. *Vermont:* Mount Mansfield (Pringle), 1876. *Ontario:* Flat Rock Portage, Lake Nipigon (Macoun 54, 17392 H. G. S. C.), 1884. *New York:* Racket Lake (Leggett), 1857. *Michigan:* Isle Royale (Porter), 1865. *Minnesota:* Fond du Lac (F. F. Wood), 1889; Gunflint Lake (F. F. Wood), 1891.

The specimens from the region of the Great Lakes are mostly very distinct, having taller culms, longer leaves, and longer, narrower, denser panicles than typical *C. breviseta.* Were it not for the occurrence of a few intergrading forms they would be regarded as representing a perfectly distinct species. The specimen from Gunflint Lake and that from Mount Willard, however, agree in habit, aspect, and size with *C. breviseta*, differing only in the floral characters above enumerated. The plant from Lake Nipigon has the panicle of the Nova Scotia specimens of *C. breviseta*, but its floral characters refer it to the variety.

20. **Calamagrostis porteri** A. Gray, Proc. Am. Acad. **6**: 79 (1862). *Deyeuxia porteri* Vasey, Descr. Cat. Grasses U. S., 51 (1885).

New York and Pennsylvania.

Type specimen collected at Pulpit Rocks, Huntingdon County, Pa., by T. C. Porter, in August, 1862.

SPECIMENS EXAMINED.—*New York:* Sullivan Hill, Chemung County (T. F. Lucy 1185), 1895. *Pennsylvania:* Alexandria, Barre Station, Warriors Ridge, Pulpit Rocks, and Porter Township, Huntingdon County (Porter), 1862–1882.

21. **CALAMAGROSTIS NEMORALIS** Kearney, sp. n. *C. porteri* Vasey: Dudley Cayuga Fl. 125 (1886), not A. Gray.

Slightly glaucous, apparently not cæspitose, of soft texture, with slender, creeping rootstocks, tall (2.5 to 4 dm.) erect innovations, and densely flowered, pale-colored panicles. Culms 10 to 15 dm. high, erect, rather slender, rather closely invested by a few long thin marcescent sheaths at base; internodes 5, all but the lowest finally considerably exceeding their sheaths, the uppermost nearly as long as both sheath and blade. Sheaths closely embracing the culm to their summits, rather firm, usually bearded at junction with the blade with short white tomentose pubescence, rather strongly scabrous on the edges, elsewhere glabrous, or nearly so. Ligule 3 to 5 mm. long, truncate, thin, rather strongly scabrous on the back. Blades (lower and of innovations) 2 to 3.5 dm. long (uppermost), 1 to 1.5 dm. long (all), 3 to 6 mm. wide, flat, rather thin, minutely but strongly scabrous on the margins and both surfaces, somewhat glaucous above, bright green beneath, lax, the lower erect, the upper spreading, the uppermost horizontal or even somewhat reflexed. Panicle 1 to 1.5 dm. long, 1.5 to 2.5 cm. wide, oblong-lanceolate, sharp-acuminate, contracted, erect, slightly flexuous; rachis rather slender, somewhat flexuous, hispidulous above, nearly glabrous toward base, its lowest internode 1.5 to 2 cm. long; branches slender, slightly flexuous, hispidulous, densely flowered, nearly erect, or the lower somewhat spreading, lower primary branches in 5's, the longest 3 to 5 cm. long. Spikelets 3.5 to 4 mm. long. Empty glumes lanceolate or oblong lanceolate, acuminate, rounded on the back or rather strongly keeled, hispidulous on the keels, elsewhere glabrous, the first slightly longer. Flowering glume, usually about equaling the second empty glume, ovate oblong, obscurely 4-dentate or almost entire, thin but rather firm, scabrous-punctate on the back; awn attached about one-fifth above the base, slightly exceeding the glume, stout, minutely scabrous, bent near the middle, the lower part somewhat twisted, the upper part divergent at a small angle and slightly exserted. Palea about three-fourths (sometimes four-fifths) as long as the flowering glume, ovate-oblong, denticulate (occasionally slightly bidentate), glabrous. Callus hairs not copious, rather stiff, bright white, the longer usually one-fourth shorter than (sometimes nearly equaling) the flowering glume. Prolongation of the rachilla, with its sparse hairs not equaling or barely equaling the longer hairs of the callus.

Maine; western New York.

Type specimen in the United States National Herbarium, collected on high ground, in woods of pine, rock-oak, hickory, etc., on Thacher's Pinnacle, Danby, near Ithaca, N. Y., by W. R. Dudley, August 1, 1884.

SPECIMENS EXAMINED.—*Maine:* Wet cliffs, Boarstone Mountain, Elliottsville, Piscataquis County; altitude 547 meters (Fernald 427), 1895. *New York:* Thachers Pinnacle (Dudley, Coville), 1884–1888.

Intermediate between *C. canadensis* and *C. porteri*. From the former it differs in its sheaths usually bearded at junction with the blade; contracted and dense panicle; stouter, bent and exserted awn; longer palea; less copious, shorter, stiffer callus hairs; and shorter hairs to the prolongation of the rachilla. From *C. porteri* it is distinguished by its laxer habit; more slender culms; usually denser panicle; smaller spikelets; smoother and thinner empty glumes; less scabrous and thinner flowering glume; shorter awn, flexuous or but slightly twisted below; shorter palea; and longer more copious callus hairs. Indicated by Dudley in the United States National Herbarium as a variety of *C. canadensis*.

B. *Awn straight or nearly so, included, callus-hairs usually not much shorter than the flowering glume.*

a. *Panicle open, the lower rays wide-spreading, leaf-blades flat or nearly so, callus-hairs copious, nealy or quite equaling the glume.*

22. **Calamagrostis langsdorffii** Trin. Gram. Unifl., 225, t. 4, f. 10 (1824). *Arundo langsdorffii* Trin. l. c., not Link.? *Calamagrostis scabra* Presl. Rel. Haenk. **1**: 234 (1828)? *C. hirtigluma* Steud. Syn. Pl. Gram. 188 (1855). *C. oregonensis* Buckl., Proc. Acad. Phila. (1862) 92 (1863). *C. columbiensis* Nutt.; A. Gray, Proc. Acad. Phila. (1862) 334 (1863). *Deyeuxia halleriana* Vasey Descr. Cat. Grasses U. S. 50 (1865), not *C. halleriana* DC.

Greenland to Alaska, south in the mountains to North Carolina, Michigan, New Mexico, and California; northern Europe and northern Asia.

Type specimen collected at Tobolsk, Siberia.

SPECIMENS EXAMINED.—*Greenland:* Godthaab, (Meehan 75), 1892. *Labrador:* Ungava Bay, (Turner 670); Ungava Bay, (Spreadborough 13197 G. S. C.), 1896; Venison Tickle, (Waghorne 13352 G. S. C.), 1891; Chateau, (J. A. Allen 20), 1882; Independent, (Waghorne 50), 1892; Turners Head, Hamilton Inlet, (Waghorne 52), 1892; Hamilton River, (Low 6082 H. G. S. C.), 1894. *Newfoundland:* St. Johns, (Robinson and Schrenk 204), 1894; Shoal Point, (Waghorne), 1895. *Nova Scotia:* Magdelan Islands (McKay 17381 H. G. S. C.), 1878. *Cape Breton:* Whyeocognah, (Macoun 17380 H. G. S. C.), 1883. *New Brunswick:* Restigouche River, (Brittain 17383 H. G. S. C.), 1888. *Quebec:* Grand Etang, Gaspé, (Macoun 26, 17377 H. G. S. C.), 1882; Mount Albert, (Macoun 17378 H. G. S. C.), 1882; Table Topped Mountain, Gaspé, altitude 912 meters, (J. A. Allen), 1887. *Maine:* Northeast Harbor, Mount Desert, (T. G. White), 1891; Mount Saddleback, Franklin County, altitude 1,064 meters. (Fernald), 1894. *New Hampshire:* Mount Willey, Ethans Pond, (C. E. Faxon), 1877; White Mountains, (Nuttall, Oakes, Tuckerman); Mount Washington, (W. Boott, Pringle, Garber, Allen), 1855–1878. *Vermont:* Mount Mansfield, (Pringle) 1876; Willoughby, (Rusby), 1892. *New York:* Mount Mackay, (Britton), 1889; Mount McIntyre, altitude, 1,426 meters, (Britton), 1892; Mount Marcy, altitude 1,368 meters, (Britton), 1892. *North Carolina:* Roane Mountain, (Curtis). *Northeast Territory:* Lake Mistassini, (J. M. Macoun 17361 H. G. S. C.), 1885; Fort George, James Bay, (J. M. Macoun 17382), 1887. *Ontario:* Thunder Bay, Lake Superior, (Macoun 160, 17384 H. G. S. C.), 1869. *Michigan:* Isle Royale, (Porter), 1865. *Saskatchewan:* Saskatchewan River, (Douglas). *Assiniboia:* Bear Lake, (Douglas? 120). *Colorado:* Clear Lake, Georgetown, (Patterson), 1885; Georgetown, (Shear 615), 1895; Robinson, Summit County, altitude 3,344 meters, (Shear 1061), 1896. *New Mexico:* Santa Fe. (Fendler 969) 1847. *Northwest Territory:* Lewis River, (Dawson 17357 H. G. S. C.), 1887; Fort Good Hope, Mackenzie River, (E. Taylor 17364 H. G. S. C.), 1892; Black River, east of Lake Athabasca, (Tyrrell 17390. 17421 H. G. S. C.), 1893. *Idaho:* St. Maries River, Kootenai County, (Henderson 2830), 1894. *Utah:* (Ward), 1875. *Alaska:* Unalaska, (Harrington), 1871–72; Kadiak Island, (Kellogg 110); (Dall 1873); Sitka, (F. Bischoff), 1865–66; (W. G. Wright 1588, 1589), 1891; Saint Michaels, (Turner 7), 1879; Lake Lindeman, head Yukon River, (Schwatka 12, 77), 1883; (Funston 136), 1891; along Yukon River, (Funston 131, 159), 1892–93; 93; Yes Bay, (Howell 174), 1895; (Seeman 1761), 1851. *British Columbia:* Fort Vancouver, (Garry 441), 1826; (Rothrock), 1865–66; Selkirk Mountains, (Macoun 17347 H. G. S. C.), 1885; Shawnegan Lake, Vancouver Island, (Macoun 17379 H. G. S. C.); Dicks Lake, Sooke, Vancouver Island, (Macoun 156), 1893; MacLeods Lake, (Macoun 17386 H. G. S. C.), 1885; Griffin Lake, altitude 1,824 meters, (Macoun 17362 H. G. S. C.); Queen Charlottes Islands, (Dawson 17387 H. G. S. C.), 1878; Upper Nechaco River, (Dawson 17388 H. G. S. C.), 1876; Fort Simpson, (McEvoy 17391 H. G. S. C.), 1893. *Washington:* Mount Adams (Howell), 1882; Mount Adams, (Suksdorf 87, 204), 1884–1886; Mount Rainier, (E. C. Smith 981), 1890; Cascade Mountains, (G. R. Vasey), 1889; Laks Kichelas, Cascade Mountains, Kittitas County, (Henderson 2157), 1892; Cascade Mountains, altitude, 1,824 meters, (Sandberg and Leiberg 795), 1893; Totoish Mountains, altitude 1,520 meters, (O. D. Allen), 1896. *Oregon:* Columbia River, (Nuttall), type of *C. columbiensis* Nutt. and *C. oregonensis* Buckl.; Rooster Rock, Multnomah County, (Suksdorf 144), 1885; Union County, altitude 1,824 meters, (Cusick 794), 1881. *California:* Sierra Nevada Mountains, (Hillebrand 8), 1863; Yosemite Valley, altitude 3,344 meters, (Bolander 6087, 6088), 1881.

CALAMAGROSTIS LANGSDORFFII LACTEA (Beal) Kearney, n. comb. *Calamagrostis lactea* Beal Grasses N. Am. **2**: 346 (1896). *Deyeuxia lactea* Suksdorf; Beal Grasses N. Am. **2**: 346 (1896).

Panicle whitish or pale green, usually tinged with pale purple, somewhat more open and flexuous; palea more than two-thirds as long as the flowering glume; callus-hairs one-sixth to one-third (usually one-fifth) shorter than the flowering glume.

Washington.

Type specimen collected on the banks of the North Fork of the Nooksak River near Mount Baker by W. N. Suksdorf (1022), 1890.

Specimens examined: Falcon Valley, 1886, (Suksdorf 206); near Mount Baker (Suksdorf 1022), 1890.

23. **Calamagrostis blanda** Beal Grasses N. Am. **2**: 349 (1896). *C. pallida* Vasey and Scribn.; Vasey Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 79 (1892), not C. Muell.

Montana and Washington.

Type specimen collected on the wet shady banks of the Klickitat River, West Klickitat County, Wash., by W. N. Suksdorf (52), July 21, 1883.

Specimens examined.—*Montana:* Helena, (Rydberg 2139½), 1895; Castle, (Rydberg 3238), 1896. *Washington:* (Suksdorf 52), 1883.

Nearly related to *C. canadensis*, but distinguished by its pale, whitish panicle with usually very flexuous branches, narrower and sharper pointed empty glumes, and awn attached near the apex and usually considerably longer than the flowering glume.

24. **Calamagrostis canadensis** (Michx.) Beauv. Agrost. 157 (1812). *Arundo canadensis* Michx. Fl. Bor. Am. **1**: 73 (1803). *Agrostis mexicana* Pers. Syn. **1**: 76 (1805)? *Arundo agrostoides* Pursh Fl. Am. Sept. 86 (1814). *Calamagrostis mexicana* Nutt. Gen. **1**: 46 (1818). *C. agrostoides* Trin. Gram. Unifl. 228 (1824). *Cinna? purshii* Kunth Enum. **1**: 208 (1833). *Arundo fissa* Willd.; Steud. Nom. Ed. 2, **1**: 144

(1840). *Deyeuxia canadensis* Munro; Hook. f., Trans. Linn. Soc. **23**: 345 (1862). *Calamagrostis michauxii Trin.*: Steud. Nom. Ed. 2, **1**: 250 (1840).

Prince Edward Island to British Columbia, south to New Jersey, Ohio, Iowa, Utah, and Oregon.

Type specimen collected in Canada by Michaux.

SPECIMENS EXAMINED.—*Prince Edward Island:* Brackley Point, (Macoun 17313 H. G. S. C.), 1888. *New Brunswick:* Campbellton, (Chalmers 17342 H. G. S. C.), 1877; Digdequash, Charlotte County, (Hay 17349 H. G. S. C.), 1883. *Quebec:* Gaspé, (Macoun 42), 1882; Salt Lake, Anticosti Island, (Macoun 17348 H. G. S. C.), 1883; Notre Dame du Lac, Temiscouata, (Northrop 205), 1887; Granby, (W. Scott 17342 H. G. S. C.), 1892; Danville, (Berg), 1894. *Ontario:* Long Point, Lake Erie, (Macoun 17351 H. G. S. C.); shore Lake Huron, (Macoun 25), 1871; Flat Rock Portage, Nipigon River, (Macoun 17360 H. G. S. C.), 1884; Port Arthur, (Britton), 1889; (J. White 17350 H. G. S. C.), 1890; Billings Bridge, Rideau River, (Macoun 7485 H. G. S. C.), 1894; Kingston, (Fowler), 1895; Humber Valley, Toronto, (W. Scott 13096 H. G. S. C.), 1896. *Maine:* Mount Desert Island, (Redfield), 1889; Van Buren, Aroostook County, (Fernald 181), 1893; Cape Elizabeth, (Scribner, Gayle), 1895; East Auburn, (Merrill), 1896. *New Hampshire:* Hampton, (Flint); Jaffrey, (Robinson 330, 333), 1897; Crawfords, White Mountains, (Churchill), 1895. *Vermont:* Smugglers Notch, (C. E. Faxon), 1897. *Massachusetts:* Ipswich, (Oakes); Revere, (H. A. Young), 1879. *Rhode Island:* (Olney). *Connecticut:* Huntingdon, (Eames), 1895. *New York:* Oxford, (Coville), 1884; Schenectady, (Wibbe), 1884; New Dorp, Staten Island, (Britton), 1890; Clear Lake, Adirondack Lodge, (Britton), 1892; Avalanche Lake, Adirondacks, (Mrs. S. B. Clarke), 1894. *New Jersey:* Clifton, (Nash), 1892; Stockholm, altitude 334 meters, (Van Sickle), 1895. *Pennsylvania:* Harrisburg, (Small), 1888. *Ohio:* Columbus, (Sullivant), 1840; (Bolander). *Michigan:* Clifton, Keweenaw County, (Farwell 527), 1887. *Wisconsin:* (Lapham); (S. H. Watson); Brown County, (Schuette), 1886; Door County, (Schuette), 1887; Wisconsin River near Knowlton, (Cheney 3345), 1895; Hurley, (Random), 1896. *Illinois:* Hyde Park, (Babcock), 1873. *Minnesota:* Duluth, (Vasey), 1887; (Sandberg 297), 1891. *Iowa:* Emmett County, (Cratty), 1889; Fayette County, (Fink 620), 1894; Marshalltown, (Eckles), 1896; Ames, (C. R. Ball 59, 133), 1896. *Manitoba:* Lake Winnepeg, (Houghton 16), 1832; Brandon, (Macoun 13092 H. G. S. C.), 1896. *North Dakota:* Churchs Ferry, Ramsey County, (Brannon 63), 1896. *South Dakota:* Custer and Hot Springs, Black Hills, altitude 1,064 to 1,520 meters, (Rydberg 1127, 1128), 1892. *Nebraska:* Whitman, Grant County, (Rydberg 1620), 1893; Aten, Cedar County, (Clements 2670), 1893. *Northwest Territory:* Cumberland House, (Richardson 37); Great Slave Lake, (E. Taylor), 1892. *Saskatchewan:* (Bourgeau), 1858; Prince Albert, (Macoun 13091, 13114 H. G. S. C.), 1896. *Montana:* (Scribner 359), 1883; Gallatin County, (Tweedy 1023), 1886; Columbia Falls, (R. S. Williams 598), 1894; Manhattan, (Shear 417), 1895; Madison River, (Shear 519, Rydberg 2278), 1895; East Gallatin Swamp, altitude 1,520 meters, (Rydberg 3203), 1896. *Wyoming:* Yellowstone Park, (Tweedy 584), 1885; Albany County, (Buffum 6), 1891. *Colorado:* Eagle River, (Coulter), 1873; (Vasey), 1888; Idaho Springs, (Shear 728), 1895. *Alberta:* Waterton Lake, Rock Mountains, (Macoun 13090 H. G. S. C.), 1895. *Utah:* Wahsatch Mountains, altitude 2,432 meters, (M. E. Jones 1274), 1879. *British Columbia:* Revelstoke, (Macoun), 1890: MacLeods Lake, (Macoun 17346 H. G. S. C.), 1895; Alberni Canal, Vancouver Island, (Macoun 17336 H. G. S. C.), 1887. *Washington:* Spokane County, (Suksdorf 86, 90a), 1884; (Henderson 2162), 1892; Wenatchie region, (Brandegee 1169). *Oregon:* Union County, (Cusick 1039).

Calamagrostis canadensis acuminata Vasey, Bull. U. S. Div. Agrost. **5**: 26 (1897); *C. canadensis robusta* Vasey in Rothr.; Wheeler Rep. **6**: 285 (1878), not *C. robusta* C. Muell.

Sheaths rarely inconspicuously bearded at junction with the blade; blade usually short scabrous-pubescent on the upper (rarely both) surfaces; panicle commonly rather small, more flexuous, more densely flowered, usually dark purple; spikelets larger (3.5 to 4 mm. long); empty glumes comparatively narrower, sharp attenuate-acuminate, sometimes subfalcate, somewhat thicker, usually much more scabrous (occasionally almost strigose); awn longer, often considerably (sometimes 0.5 mm.) exceeding the flowering glume.

This variety represents a transition from *C. canadensis* to *C. langsdorffii.* The extreme form can be distinguished from the latter species only by its smaller spikelets and usually shorter awn and less scabrous empty glumes. It is most abundant in the Rocky Mountain region, where it largely replaces the typical forms of both the related species.

Labrador and Newfoundland; high mountains of North Carolina; Keewatin to Alaska, south in the mountains to New Mexico and California.

Type specimen collected in California by H. N. Bolander (6087), 1866.

SPECIMENS EXAMINED.—*Labrador:* Esquimaux River, (J. A. Allen 19), 1882. *Newfoundland:* (Waghorne 31), 1896. *North Carolina:* Roan Mountain, (Scribner), 1889. *Keewatin:* Severn River, (J. M. Macoun 17352 H. G. S. C.), 1886. *Athabasca:* (Macoun 116), 1872. *Assiniboia:* Moose Jaw, (Macoun 56), 1880. *Montana:* Deep Creek, altitude 1,368 meters, (Scribner 358), 1883; Beaver Creek, (Scribner 226), 1883; Lima, (Shear 553), 1895; Manhattan, (Shear 419, 424), 1895; Manhattan, (Rydberg 2189), 1895; Helena, (Rydberg 2139½), 1895; East Gallatin swamps, altitude 1,520 meters, (Rydberg 3202), 1896; Castle, (Rydberg 3235), 1896; Yogo Gulch, altitude 1,520 meters, (Rydberg 3408), 1896; Bridger Canyon, altitude 1,672 meters, (Rydberg 3205), 1896; Spanish Creek, altitude 1,824 meters, (Rydberg 3016, 3024, 3049, 3073), 1896; Barker, altitude 1,520 meters, (Rydberg 3365, 3366), 1896; Dry Fork Belt Creek, altitude 1,216 meters, (Rydberg 3358), 1896; Belt Pass, altitude 1,976 meters, (Rydberg 3333), 1896; Spanish Creek, (T. A. Williams 2027), 1896; Spanish Creek Basin, altitude 2,432 meters, (T. A. Williams 2057½), 1896. *Yellowstone National Park:* Pelican Creek, (Tweedy 584), 1885; Yellowstone River Upper Falls, (Hayden 77), 1871; (Letterman 46), 1885; Mammoth Hot Springs, altitude 1,884 meters, (Burglehaus), 1893. *Wyoming:* Lincoln Gulch, (Nelson 2625), 1896; (Parry 300), 1873. *Colorado:* Twin Lakes, Eagle River, (Coulter), 1873; Twin Lakes, (Wolf 1093), 1873, (type of *C. canadensis robusta* Vasey); Golden City, (Greene), 1871; La Plata Mountains, (Eastwood 13), 1891; Steamboat Springs, Routt County, (Eastwood 21), 1891; Clear Lake, Georgetown, (Rydberg 2375), 1895; Georgetown, altitude 2,888 meters, (Patterson 31), 1885; Georgetown, (Shear 611), 1895; Idaho Springs, (Shear 721), 1895; Buenavista, Chaffee County, altitude 3,040 meters, (Shear 1004, 1019), 1896; Veta Pass, Costilla County, altitude 2,860 meters, (Shear 337), 1896; Villa Grove, Saguache County, altitude 2,736 meters, (Shear 888, Clements 125), 1896; Marshall Pass, Saguache County, altitude 3,280 meters, (Shear 903, Clements 225), 1896; Breckenridge, Summit County, altitude 2,888 meters, (Shear 1075), 1896; Ruxton Creek, Pikes Peak (Clements 12), 1896; Pikes Peak (T. A. Williams 2178, 2181; Shear 722), 1896. *New Mexico:* Santa Fe Creek, (Fendler 957), 1847. *Northwest Territory:* Mackenzie River, (McConnell 17359 H. G. S. C.), 1888. *Idaho:* Henrys Fork, (Hayden), 1872; Lake Tesemini, Kootenai County, (Sandberg 694), 1892; Cœur d'Alene River, Kootenai County, (Sandberg 637), 1892; Lake Cœur d'Alene, (Sandberg 561, 578), 1892; Palouse Country and Lake Cœur d'Alene, (G. B. Aiton 37), 1892; Grangeville, Camas Prairie, (Henderson 2831), 1894; Beaver Canyon, (Rydberg 2328), 1895; Petit Lake, (Evermann 311), 1895; Redfish Lake, altitude 2,128 meters, (Evermann 427), 1895. *Utah:* Southern Utah, (Palmer 482), 1877. *Arizona:* Rincon Mountains, altitude 2,280 meters, (Nealley 70), 1891. *Alaska:* Yukon River, (Kennicott). *British Columbia:* Fraser River, (Lyall), 1859; Donald, Columbia Valley, (Macoun 53, 17353 H. G. S. C.), 1895; Adams Lake, altitude 1,700 meters, (Dawson 17314 H. G. S. C.), 1888; Vancouver Island, (Macoun 124), 1887; Griffin Lake, (Macoun 35), 1889; Kamloops, (Macoun 17354 H. G. S. C.). 1889; Revelstoke, (Macoun 17356 H. G. S. C.), 1890: Comox, Vancouver Island. (Macoun 155 H. G. S. C.), 1893. *Washington:* Cascade Mountains, (Brandegee 1168), 1883; Cascade Mountains, (G. R. Vasey), 1889; Cascade Mountains, (Lyall). 1860; Spokane County, (Suksdorf 89), 1884; Falcon Valley, (Suksdorf 207), 1886; West Klickitat County, (Suksdorf 142, 208, 2127), 1885–1892; Skamania County, (Suksdorf 203. 205). 1886: North Fork Nooksak River, near Mount Baker, (Suksdorf 2166), 1890: Mount Adams. (Howell 82. Suksdorf 209). *Oregon:* Sauvies Island, (Howell), 1883; Hood River, (Howell 191), 1886; Rogue River Valley, (Howell), 1887; Crater Lake, altitude 1,870 meters, (Coville and Leiberg 412), 1896. *California:* (Bolander 818, 6087, 6088), 1866; Merced River, (Bolander), 1866; Calaveras County, (Hillebrand 2244, 2245); Donner Lake, Sierra Nevada Mountains, (Torrey 559), 1865; Merced River, (Torrey 559c), 1865.

CALAMAGROSTIS CANADENSIS CAMPESTRIS Kearney, var. n.

Low (not exceeding 5.5 dm.); leaf-blades erect, rather firm, somewhat involute, the largest 12 cm. long and 2 mm. wide; panicles small, the largest 9 cm. long and 3 cm. wide, densely flowered, somewhat flexuous, straw-color, tinged with pale purple, the branches somewhat spreading or nearly erect, the longest 4 cm. long; spikelets 3.5 mm. long; empty glumes acuminate, hispidulous on the keel, elsewhere minutely scabrous: palea about one-fifth shorter than the flowering glume; callus-hairs copious, about equaling the palea.

Type specimen in the United States National Herbarium, collected on the borders of marshes on the open prairie, Louis Plain, Assiniboia, by J. M. Macoun (56, 17418 H. G. S. C.), July, 1883.

25. **Calamagrostis macouniana** Vasey, Monog. Grasses. U. S., Contr. U. S. Nat. Herb. **3**: 81 (1892). *Deyeuxia macouniana* Vasey; Coult. Bot. Gaz. **10**: 297 (1895).

Assiniboia to Missouri, Montana, and Washington.

Type specimen in the United States National Herbarium, collected on the borders of marshes, Louis Plain, Assiniboia, by J. M. Macoun (44), 1883.

Specimens examined.—*Missouri:* Little Blue, Jackson County, (Bush. 386), 1896. *Manitoba:* Black River, Lake Winnipeg, (J. M. Macoun 17391 H. G. S. C.), 1881. *South Dakota:* Chamberlain, (E. N. Wilcox 6), 1892. *Assiniboia:* Louis Plain, (Macoun 44, 45, 17393 H. G. S. C.). *Montana:* Manhattan (Rydberg 2191½; Shear 422). *Washington:* Spokane County, (Suksdorf 1097), 1889.

Distinguished from *C. canadensis* by its usually stricter habit, smaller, more contracted, and denser panicles and small spikelets. The Missouri plant approaches *C. canadensis* in its somewhat larger spikelets, looser panicles, and laxer habit.

b. *Panicle more or less contracted.*

**Leaf-blades flat or nearly so, panicle not spiciform.*

†*Prolongation of rachilla bearded its whole length, caryopsis glabrous.*

‡*Callus-hairs copious, two-thirds as long as to longer than the flowering glume.*

26. **Calamagrostis scribneri** Beal, Grasses N. Am., **2**: 343 (1896). *Deyeuxia dubia* Scribn.; Coult., Bot. Gaz. **11**: 70 (1886). *Calamagrostis dubia* Scribn.; Vasey, Monog. Grasses U. S., Contr. U. S. Nat. Herb., **3**: 80 (1892). *C. canadensis dubia* Vasey, l. c.

Montana and Yellowstone Park to British Columbia and Washington.

Type specimen collected along Slough Creek, Yellowstone Park, altitude 2,031 meters, by F. Tweedy (585), 1885.

Specimens examined.—*Montana:* Belt Mountains, (R. S. Williams 551), 1886; Fort Logan, altitude 1,520 meters, (Scribner 365), 1883; (Knowlton) 1887; Spanish Creek, altitude 1,824 meters, (Rydberg 3083, 3096, 3100; T. A. Williams 2009), 1896; East Gallatin Swamps, altitude 1,520 meters, (Rydberg 3203), 1896: Spanish Creek Basin, altitude 2,432 meters, (T. A. Williams 2057), 1896. *Wyoming:* Yellowstone Park, (Tweedy 585), 1885. *Colorado:* (Wolf 664) 1873; (Letterman 44, 45), 1885. *Alberta:* Devils Head Lake near Banff, altitude 1,426 meters, (Macoun 23),

1891. *British Columbia:* Kicking Horse Lake, altitude 1,520 meters, (Macoun 20b), 1890. *Washington:* Mount Adams, altitude 1,520 to 1,824 meters, (Suksdorf 145), 1885; Chiquash Mountains, Skamania County, (Suksdorf 1023), 1890.

Related to *C. canadensis* and *C. langsdorffii*, differing from both in its stricter habit, culms rarely branching from the upper nodes, sheaths almost always bearded at junction with the blade, upper leaf surface usually conspicuously glaucous, panicle narrow, contracted, with shorter, more nearly erect branches, callus hairs shorter, and palea longer. From *C. canadensis* it is also distinguished by its longer and stouter awn, and from *C. langsdorffii* by its paler color, merely scabrous leaf-blades, straight or but slightly flexuous panicle and less scabrous and thinner empty glumes. Forms intergrading with *C. canadensis acuminata* occur, but the species is, on the whole, well marked. The type specimen represents the extreme and most distinct form.

27. **CALAMAGROSTIS ALASKANA** Kearney, sp. n.

A strongly cæspitose plant of rather soft texture, with numerous somewhat elongated (often 1.5 dm.) erect innovations and tall culms from strong creeping rootstocks. Culms 10 to 12 dm. high, erect but not strict, rather slender, rather closely enveloped at base by numerous thin marcescent sheaths; internodes 4, the lowest very short, the others elongated and finally considerably exceeding their sheaths, the uppermost exceeding both sheath and blade. Sheaths closely embracing the culm nearly to their summit, usually somewhat twisted about the culm, thin, glabrous, except the minutely scabrous margins. Ligule 2 to 4 mm. long, somewhat narrowed to the broad, rounded apex, thin but firm. Blades 1 to 3 dm. long, 1.5 to 3.5 mm. wide, usually somewhat involute, especially toward the filiform apex, strongly scabrous on the nerves and margins, sparsely short pubescent above. Panicle 10 to 16 cm. long, 2 to 3 cm. wide, oblong-lanceolate, acuminate, erect, strongly-flexuous, contracted, densely flowered, light brown, sometimes tinged with pale purple; rachis rather slender, scabrous, the lowest internode about 2 cm. long; branches slender, somewhat flexuous, strongly hispidulous, the lower primary branches in 3's or 4's, nearly erect or somewhat spreading, the longest 3 to 3.5 cm. long. Spikelets about 4 mm. long. Empty glumes ovate-lanceolate, sharp-acuminate, rounded on the back, thin but firm, scabrous on the nerves, elsewhere obscurely scabrous-punctate to short-strigose, the first somewhat longer. Flowering glume nearly 1 mm. shorter than the second empty glume, ovate oblong, minutely 4-dentate, thin-membranous with hyaline margins and tip, minutely scabrous on the back; awn attached two-fifths to three-fifths above the base, 1.5 to 2.5 mm. long, slightly exceeding the glume, straight, erect, slender to rather stout. Palea mostly two-thirds, sometimes three-fourths as long as the flowering glume, ovate-oblong, bidentate, glabrous. Anthers about 2 mm. long. Callus-hairs copious, rather stiff, spreading, bright white, the longer considerably (sometimes 1 mm.) longer than the flowering glume. Prolongation of the rachilla with its hairs about equaling the longer ones of the callus.

Allied to *C. lapponica* (Wahl.) Hartm., from which it differs in its more cæspitose habit, culms rather closely invested at base with numerous marcescent sheaths, stouter rootstock, longer and firmer ligule, more involute leaf-blades, more flexuous, less interrupted, and more densely flowered panicle, broader, more abruptly pointed, usually less scabrous empty glumes, straight awn and shorter palea.

Type specimen in the United States National Herbarium, collected along the Yukon River, Alaska, by Frederick Funston (157), in August, 1893.

‡‡ *Callus-hairs sparse, much shorter than the glume.*

28. **Calamagrostis cusickii** Vasey, Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 81 (1892). *Deyeuxia cusickii* Vasey; Coult. Bot. Gaz. **10**: 224 (1885).

Eastern Oregon and northern California.

Type specimen in the United States National Herbarium, collected in the shade of *Pinus contorta* Dougl. on the Eagle Creek Mountains, eastern Oregon, altitude 1,520 to 1,824 meters, by W. C. Cusick (814), in 1879; "rarely sends up culms."

SPECIMENS EXAMINED.—*Oregon:* Eagle Creek Mountains, altitude 1,520 meters (Cusick 814), 1879. *California:* Cahto, Mendocino County (Bolander, 1159).

Related to *C. suksdorfii* but distinguished by its greater size, numerous innovations with very long, lax leaf-blades, and shorter, straight or but slightly bent, usually included awn.

29. **Calamagrostis scopulorum** M. E. Jones, Proc. Calif. Acad. Sci. (II) **5**: 722 (1895).

Utah.

Type specimen collected at the base of sandstone cliffs along the Virgin River, above Springdale, altitude 1,216 meters, by M. E. Jones (6075), September 25, 1894.

CALAMAGROSTIS SCOPULORUM LUCIDULA Kearney, var. n.

Smaller, pale but not glaucous (*C. scopulorum* is conspicuously white glaucous throughout), apparently more cæspitose; with short, firm leaf-blades (elongated and lax in *C. scopulorum*); stricter, greenish or lead colored, somewhat shining panicle; and more compressed spikelets.

Type specimens collected at Altah, Wahsatch Mountains, Utah, altitude 2,584 meters, by M. E. Jones (1145),[1] 1879.

A very distinct form, and with more complete material it will probably be found expedient to separate it as a species.

†† *Prolongation of rachilla bearded only near apex, caryopsis pubescent.*

30. **Calamagrostis cinnoides** (Muhl.) Bart., Comp. Fl. Phila. **1**: 45 (1818). *Agrostis glauca* Muhl. Descr. Gram. 76 (1817), not *Arundo glauca* Bieb. *Arundo cinnoides* Muhl. Descr. Gram. 187 (1817). *Calamagrostis canadensis* Nutt. Gen. **1**: 46 (1818), not Beauv. *Arundo stricta* Spreng. Neu. Entdeck. **1**: 247 (1820). *Phalaris arundinacea* Spreng. l. c. *P. americana* Spreng. l. c. *Calamagrostis langsdorffii marylandica* Trin. Gram. Unifl. 225 (1824). *C. glauca* Trin. l. c. *Arundo coarctata* Torr. Fl. U. S. 94 (1824). *A. canadensis* Nutt., Steud. Nom. Ed. **1**: 144 (1840). *Calamagrostis nuttalliana* l. c. 251. *Calamagrostis coarctata* Torr. Fl. N. Y. **2**: 441, Pl. 151 (1843). *Deyeuxia nuttalliana* Vasey Descr. Cat. Grasses U. S. 51 (1885).

Maine to Ohio, middle North Carolina, and central Alabama.

Type specimen collected in swamps in Pennsylvania.

SPECIMENS EXAMINED.—*Maine:* Wells, (Blake). *New Hampshire:* White Mountains (Oakes). *Massachusetts:* Ipswich, (Oakes); Salem, (Pickering); Essex County, (Conant). *Connecticut:* Litchfield, (Torrey), (Eaton); New Haven, (J. A. Allen), 1879; Bridgeport, (L. N. Johnson); Stratford, (Eames), 1895. *New York:* Arlington, Staten Island, (Britton), 1895. *Pennsylvania:* Philadelphia, (Conrad); Pocono Plateau, (Traill Green), 1858–59; Pocono Summit, Monroe County, (Porter), 1889; Tobyhanna, (Britton), 1887; Smithville, Lancaster County, (Porter, Small); Penryn, (Small), 1889. *New Jersey:* Hackensack Meadows, (Torrey); Middleton, (Gray), 1833; Egg Harbor, (Vasey), 1881. *Delaware:* Dover, (Canby), 1863. *Maryland:* Baltimore, (Foreman), 1873; Takoma Park, Prince George County, (Scribner, Kearney), 1894–95. *District of Columbia:* Terra Cotta, (Ward), 1877. *North Carolina:* (McCarthy), 1884; Dunns Mountain, Rowan County, altitude 304 meters, (Small), 1891. *South Carolina:* Cæsars Head, (J. D. Smith), 1881. *Ohio:* (Bolander). *East Tennessee:* (P. L. Cobb), 1891. *Alabama:* Tuscaloosa, (Mohr); Cullman, (Eggert 62), 1897.

---

[1] M. E. Jones's 1145A is the same.

The most isolated as to relationship of the North American species, differing from all others in its hairy caryopsis and its prolongation of the rachilla villous only near the summit. In habit and appearance it resembles some of the European species of the Section *Epigeos*.

** *Leaf-blades strongly involute.*

† *Culms and usually almost filiform leaf-blades not rigid, plant not strongly cæspitose.*

31. **CALAMAGROSTIS LAXIFLORA** Kearney, sp. n. *C. neglecta gracilis* Scribn.; Coult. Bot. Gaz. **11**, 175 (1886), not *C. gracilis* Seenus.

A small, nearly glabrous species of pale color and soft texture, with slender creeping rootstocks, short (4 cm. or less), erect innovations, strict culms, involute leaf blades and small, rather open and flexuous panicles. Culms 2.5 to 3.5 dm. high, slender, with a few short, loose, thin, marcescent sheaths at base; internodes usually 3, the uppermost finally exceeding its sheath, the others apparently shorter than their sheaths. Sheaths open toward summit, thin but rather firm, glabrous. Ligule about 3 mm. long, truncate, thin but rather firm, nearly glabrous. Blades 5 to 13 (mostly about 10) cm. long, 2 to 3 mm. wide, strongly involute from the base to the filiform tip, erect or nearly so, slightly scabrous on the margins and nerves on the upper surface. Panicle 4.5 to 7 cm. long, 1 to 2 cm. wide, ovate to oblong-lanceolate, acutish, erect, strongly flexuous, rather open and loosely flowered, straw-color tinged with pale purple; rachis slender, strongly flexuous, glabrous below, sparsely and minutely hispidulous above, the internodes comparativaly elongated, the lowest about 1 cm. long; branches slender, strongly flexuous, rather loosely flowered, somewhat sparsely hispidulous, the lower primary branches mostly in 3's, somewhat spreading (sometimes nearly 45 degrees), the longest 1.5 to 2.5 cm. long. Spikelets about 3 mm. long. Empty glumes lanceolate to ovate-lanceolate, short acuminate, rather strongly keeled, minutely hispidulous on the keel, otherwise glabrous, thin, firm, membranous, the first slightly longer. Flowering glume 2.5 to 3 mm. long, slightly shorter than the second empty glume, ovate, narrowed to the truncate apex, minutely 4-dentate, hyaline, nearly glabrous; awn attached one-third to two-fifths above the base, equaling or very slightly exceeding the glume, very slender, erect, straight. Palea about three-fifths as long as the flowering glume, ovate oblong, minutely bidentate, glabrous. Anthers 2 mm. long. Callus-hairs not copius, soft, bright white, slightly shorter than to equaling the flowering glume. Prolongation of the rachilla, with its rather sparse hairs about equaling the longer ones of the callus.

Type specimen in the United States National Herbarium collected in meadows on the East Fork of the Yellowstone River, Yellowstone Park, by Frank Tweedy (582), in August, 1885.

Related to *C. neglecta*, but readily distinguished by its smoothness, pale color, more open and flexuous, loosely flowered panicle and longer callus hairs. Separated from *C. neglecta* in the National Herbarium as a variety by Dr. Vasey.

32. **Calamagrostis neglecta** (Ehrh.) Gaertn.; Gaertn. Mey. und Scherb. Fl. Wetterau **1**:94 (1799). *Arundo neglecta* Ehrh. Beitr. **6**:84, 137 (1791). *A. stricta* Timm.; Siemss. Mecklenb. Mag. **2**:235; Schrad. Fl. Germ. 215 (1806). *Calamagrostis stricta* Koel. Descr. Gram. 105 (1802). *Deyeuxia neglecta* Kunth Rev. Gram. **1**:76 (1835). *Calamagrostis coarctata* Hook. Fl. Bor. Am. **2**:240 (1839). *C. lapponica* A. Gray, Proc. Am. Acad. **6**:78 (1866) in part. *Deyeuxia neglecta brevifolia* Vasey, Macoun Cat. Can. Pl. **4**:206 (1888).

Labrador to Alaska, south to northern Maine, Wisconsin, Colorado, and Oregon; northern Europe and northern Asia.

Type specimen collected at Upsala, Sweden.

Specimens examined.—*Arctic seacoast:* (Richardson). *Labrador:* (Morison 401 in Herb. Hook.); Ungava Bay, (Turner); Independent, (Waghorne), 1892; Eagle River, (Waghorne), 1893. *Newfoundland:* Long Point, (Waghorne), 1892; Bay of Islands, (Waghorne 55), 1896; Holton, (Waghorne), 1892. *Nova Scotia:* Amherst

Island, (Richardson 17412 H. G. S. C.), 1880. *Prince Edward Island:* Mount Stewart, (Macoun 17413 H. G. S. C.), 1888. *New Brunswick:* Shediac, (Brittain 17411 H. G. S. C.), 1884; Ingleside, (Brittain 21), 1890. *Canada:* (Pursh). *Quebec:* Cape Rosier, Gaspé, (Macoun 17416 H. G. S. C.), 1882. *Maine:* Fort Fairfield, Aroostook County, (Fernald 182), 1893. *Northeast Territory:* East Main River, (A. H. D. Ross 17415 H. G. S. C.), 1892. *Ontario:* Shore Lake Superior, (Macoun 132), 1869. *Wisconsin:* Madison, (Hale), 1860. *Minnesota:* (No data). *Assiniboia:* Cypress Hills, (Macoun 13106 H. G. S. C.), 1895. *Montana:* (Scribner 361), 1883. *Colorado:* Twin Lakes, (Wolf 721, 1013, 1097), 1873; Georgetown, (Shear 618), 1895. *Idaho:* (Wheeler Expedition), 1871. *Alaska:* Fort Yukon, (Bates), 1889. *Northwest Territory:* Fort Pelly Banks, (Dawson 99), 1887, type of *Deyeuxia neglecta brevifolia* Vasey. *Washington:* Spokane County, (Suksdorf 90), 1884. *Oregon:* Camp Polk, (Howell 168), 1885; Columbia Plains, (Nuttall). *Rocky Mountains:* (Hall and Harbour 619), 1862.

An extremely variable species throughout its range. The unsatisfactory condition of the European forms makes it impossible at present to clearly define the species as represented in North America. Extreme forms approach *C. strigosa* (Wahlenb.) Hartm. in their narrow, sharp-acuminate, scabrous empty glumes, but are distinguished by their strongly involute leaves and smaller spikelets. On the other hand, specimens from Long Point, Newfoundland, collected by Waghorne, somewhat resemble *C. lapponica* (Wahlenb.) Hartm. in their lanceolate, rather open panicles, thin and nearly glabrous empty glumes, and curved, almost geniculate awn, but differ markedly in their small size, closely involute leaves, small spikelets, and narrow, empty glumes. Other specimens from Holton and Independent, Newfoundland, approach forms of *C. hyperborea*, differing chiefly in their softer texture and less scabrous glumes.

CALAMAGROSTIS NEGLECTA BOREALIS (Laest.) Kearney, n. comb. *C. borealis* Laest. Bidr. Vaextl. Torn. Lappm. Ups. 44 (1860). *C. stricta borealis* Lange Consp. Fl. Grœnl. 161 (1880). *Deyeuxia vancouverensis* Vasey, Bull. Torr. Club **15**: 48 (1888). *Deyeuxia borealis* Macoun Cat. Can. Pl. **4**: 207 (1888).

Small (2 to 3 dm. high); longest leaf-blades not exceeding 1 dm.; panicle small, 3 to 5 cm. long, 5 to 10 mm. wide, spikelike, usually very dense, dark purple or chestnut brown; spikelets about 3 mm. long; empty glumes ovate, acute; flowering glume nearly equaling the empty ones.

Labrador and the Hudson Bay region; northern Europe.

Type specimen collected in Lapland.

SPECIMENS EXAMINED.—*Labrador:* Attikonak Branch, Hamilton River (Low 6080, 6081, G. S. C.), 1894. *Northeast Territory:* Fort George, James Bay (J. M. Macoun 125, 17414 H. G. S. C.), 1887 (type of *Deyeuxia vancouverensis* Vasey and of *D. borealis* Macoun).

This variety is related to *C. holmii* Lange,[1] which, however, is even a smaller plant (mostly about 1 dm. high), with ascending culms, leaves crowded at the base of the culm with short comparatively widespreading blades, longer spikelets and more acuminate empty glumes.

CALAMAGROSTIS NEGLECTA CANDIDULA Kearney, var. n.

Whole plant pale and glaucous; culms 3 to 4 dm. high, rather hard and rigid, comparatively stout, sometimes strongly arcuate below; leaf-blades somewhat rigid; panicle 6 to 10 cm. long, 1 to 1.5 cm. wide, oblong-lanceolate, densely many-flowered, whitish, tinged with pale purple; spikelets about 4 mm. long; empty glumes rather firm in texture; flowering glume considerably shorter than the second empty one; awn attached one-fifth to two-fifths above the base, not nearly equaling the glume, rather stout, somewhat curved; palea very nearly equaling the flowering glume; callus-hairs very sparse, the lateral ones about three-fifths as long as the flowering glume, the dorsal ones much shorter; prolongation of the rachilla with its hairs somewhat shorter than the palea.

---

[1] Lange: Holm Novaia-Zemlias Vegetation 20, t. 1, p. 2 (1887). A form of this species has been collected on Wrangel Island, Siberia, and many extend to some of the Alaskan islands.

Type specimen in the herbarium of the geological survey department of Canada (7483), collected on open prairies, evidently in wet soil, in the Cypress Hills, Assiniboia, by John Macoun, June 20, 1894.

A very distinct variety, and may prove to be a good species.

CALAMAGROSTIS NEGLECTA WRIGHTII Kearney, var. n.

Small (2 to 3 dm. high); innovations numerous; leaf-blades nearly flat, 2 to 3 mm. wide; panicle small (4 to 5 cm. long), flexuous, few-flowered.

Type specimen in the United States National Herbarium, collected on Arakamchetchene Island, Bering Straits, by Charles Wright (U. S. North Pacific Expl. Exp.), 1853–56, and distributed as *C. strigosa* Bong.

33. CALAMAGROSTIS MICRANTHA Kearney, sp. n.

A slender plant of rather soft texture, with slender creeping rootstocks, erect elongated innovations, erect culms rather closely enveloped at base by a few long marcescent sheaths and contracted spike-like panicles of very small spikelets. Culms 4.5 to 5.5 dm. high, very slender, strict; internodes 3, the two upper much exceeding their sheaths, the uppermost finally exceeding both sheath and blade. Sheaths closely embracing the culm, thin, glabrous. Ligule 1.5 mm. or less in length, truncate or rounded, rather firm, glabrous, whitish. Blades (of innovations and the lower cauline) about 2 dm. long (uppermost cauline), 6 to 12 cm. long; all 1 to 1.5 mm. wide, involute filiform near apex but elsewhere flat, erect but not rigid, thin, scabrous on the margins, minutely scabrous-pubescent on the nerves above, glabrous beneath. Panicle about 8 cm. long, 1 cm. in greatest width, narrow-oblong, acutish, erect, sometimes somewhat flexuous toward apex, densely flowered, somewhat interrupted toward base, dark purple; rachis slender, sparsely scabrous-pubescent (nearly glabrous toward base), its lowest internode about 1.5 cm. long; branches slender, appressed, minutely scabrous-pubescent, flexuous, densely flowered, the lower primary branches in 1's to 5's, the longest 1 to 1.5 cm. long. Spikelets about 2 mm. long. Empty glumes ovate, acutish, rounded on the back, thickish, strongly hispidulous on the keel, elsewhere scabrous especially toward apex, dark red-purple, the first slightly longer and narrower. Flowering glume only slightly shorter than the empty glumes, broadly ovate, deeply bifid, minutely denticulate, rather firm-membranous with hyaline tip and edges, scabrous-punctate on the back, usually tinged with red-purple; awn attached at the middle or slightly below, 1 to 1.5 mm. long, usually considerably exceeding the glume (sometimes merely equaling it), straight, comparatively stout. Palea about three-fourths as long as the flowering glume, much narrower, strongly keeled, bifid, glabrous. Anthers about 1 mm. long. Callus-hairs soft, usually one-half (sometimes four-fifths) as long as the flowering glume. Prolongation of the rachilla, with its sparse hairs, somewhat surpassing those of the callus.

Type specimen in the United States National Herbarium, collected in a "mooskeg" north of Prince Albert, Saskatchewan, by John Macoun (13111 G. S. C.), July 1, 1896.

Nearly related to and resembling in habit and appearance *C. neglecta* from which it differs in its flatter leaves, narrower panicles, very small spikelets, and ovate, merely acutish, thicker and more scabrous empty glumes.

†† *Culms and usually wider leaf-blades rather hard, more or less rigid.*

‡ *Panicle elongated, rather loosely flowered, plant tall, not cæspitose, or but slightly so.*

34. **Calamagrostis inexpansa** A. Gray, Gram. et Cyp. **1**: No. 20 (1834); Torr. Fl. N. Y. **2**: 415, t. 152 (1843). *C. confinis* A. Gray Man. Ed. 2, 547 (1856), not Nutt. (?)[1] *C. neglecta confinis* Beal Grasses N. Am. **2**: 353 (1896).

New Jersey and western New York to South Dakota and Colorado.

Type specimen collected at Penn Yan, Yates County, N. Y., by Dr. Sartwell in 1833.

Specimens examined. *New Jersey:* (A. Gray). *New York:* Penn Yan, Yates County, (Sartwell) 1833. *Pennsylvania:* Lycoming County, (McMinn), 1869. *Illinois:* Chicago, (Babcock), 1873. *Minnesota:* (Sandberg), 1891. *Iowa:* Emmett County, (Cratty), 1882; Armstrong, (Cratty 311); Marshalltown, (Eckles), 1896. *Missouri:* Courtney, (Bush), 1890. *South Dakota:* Rosebud, (Wallace 31), 1896. *Wyoming:* Albany County, (Buffum 12), 1891. *Colorado:* Pen Gulch, altitude 2,432 meters, (Vasey), 1884.

On the western limit of its range *C. inexpansa* appears to intergrade with *C. hyperborea elongata*, but is in the main readily distinguished from any form of that species by its less cæspitose or not at all cæspitose and less rigid habit, taller culms less closely enveloped at base by the marcescent sheaths often longer and proportionately narrower leaf-blades, longer and looser panicle with longer internodes and branches, usually longer spikelets, and usually more pointed empty glumes.

CALAMAGROSTIS INEXPANSA CUPREA Kearney, var. n.

Somewhat stouter and more rigid; panicle more densely flowered, sometimes 4 cm. wide; spikelets smaller, 3 to 4 mm. long; empty glumes copper-colored or dark purple, with copper-colored tips.

Type specimen in the United States National Herbarium, collected in shallow water, Falcon Valley, Washington, by W. N. Suksdorf (910), July 9, 18, 1886. Distributed as *Deyeuxia canadensis* Beauv. var.

Specimens examined: Falcon Valley (Suksdorf 143, 202, 910), 1885–86.

CALAMAGROSTIS INEXPANSA BARBULATA Kearney, var. n.

Culms stout, pubescent just below the strongly constricted nodes with short, reflexed hairs, slightly scabrous for some distance below the pubescence; sheaths strongly twisted; panicle rather rigid, purplish; awn very short, attached above the middle, not equaling the glume, often entirely wanting.

Type specimen in the United States National Herbarium, collected in Mason County, Wash., by Charles V. Piper (947), July 26, 1890. An imperfect specimen, not showing the basal parts. May prove to be a distinct species.

35. **CALAMAGROSTIS CALIFORNICA** Kearney, sp. n.

Slightly glaucous, apparently not cæspitose, with elongated (sometimes 15 cm. long), erect innovations; tall, strict but not rigid, slender culms; long, narrow leaf-blades and long, narrow, contracted panicle. Culms 7.5 to 10 dm. high, with one or two long, loose, thin marcescent sheaths at base; nodes inconspicuously or not at all constricted; internodes 3, the two upper finally elongated and exceeding their sheaths, the uppermost greatly exceeding both sheath and blade. Sheaths rather loose, glabrous except the minutely scabrous margins. Ligule 2 to 3 mm. long, broadly truncate, firm-membranous, minutely ciliate. Blades (of lower leaves and innovations) 2 to 4 dm. long (uppermost cauline)

---

[1] *Calamagrostis confinis* Nutt. Gen. **1**: 47 (1818) is based upon *Arundo confinis* Willd. Enum. Hort. Berol., 127 (1809). Willdenow's description does not apply to *C. inexpansa*, for he describes the awn as geniculate and as resembling that of *Arundo sylvatica* Schrad. (*C. sylvatica* DC). What Willdenow's plant really was can not be determined from his characters. *Calamagrostis porteri* A. Gray corresponds in every particular, except its short callus hairs.

2 dm. or less in length, all 1 to 4 mm. wide, strongly involute and almost filiform (or occasionally nearly flat), erect, more or less flexuous, thickish, strongly hispidulous-scabrous on the margins and on the upper surface, glabrous beneath. Panicle about 2 dm. long, about 2 cm. wide, oblong-lanceolate, acuminate, erect, flexuous, straw-colored, faintly tinged with purple; rachis slender, sparsely scabrous above, glabrous toward base, its internodes somewhat elongated, the lowest about 4 cm. long; branches slender, appressed, rather densely flowered, scabrous-pubescent, the lower primary branches in 6's to 8's, the longest 5 to 6.5 cm. long. Spikelets about 4 mm. long. Empty glumes lanceolate, acuminate, somewhat strongly keeled toward apex, thin membranous, hispidulous on the keels, elsewhere strongly scabrous, the first slightly longer. Flowering glume about 3 mm. long, slightly shorter than the second empty glume, ovate, broadly truncate, very minutely 4 to 6 dentate, thin membranous with subhyaline edges and tip, scabrous on the back; awn attached about two-fifths above the base, equaling or slightly shorter than the glume, straight, rather stout. Palea about three-fourths (rarely four-fifths) as long as the flowering glume, oblong-ovate, deeply bifid with obtuse teeth, glabrous. Anthers about 2 mm. long. Callus-hairs copious, soft, bright white, the longer one-half (occasionally three-fifths) as long as the flowering glume. Prolongation of the rachilla, with its hairs equaling or slightly exceeding the palea.

Type specimen in the United States National Herbarium, collected in the Sierra Nevada Mountains, California, by J. G. Lemmon (444), 1875.

Much resembling and nearly related to *C. inexpansa*, but differing in its somewhat softer texture; culms glabrous, with nodes not constricted; ligule shorter (about one-half as long) and thicker; leaf-blades glabrous beneath; spikelets mostly smaller; empty glumes nearly equal, less sharply acuminate, thinner and usually less scabrous; flowering glume sometimes 6-dentate; awn longer, attached somewhat higher and less scabrous; palea broader, more conspicuously toothed; and hairs of the callus and of the prolongation of the rachilla much shorter.

‡‡ *Panicles mostly short, dense, spiciform; plants usually low and strongly cæspitose.*

36. CALAMAGROSTIS LABRADORICA Kearney, sp. n.

A small rigid plant of hard texture, somewhat glaucous, short-stoloniferous, with erect rather long innovations, strict culms, erect strongly involute leaf-blades and narrow spike-like panicles. Culms 3.5 to 5 dm. high, rather stout, closely enveloped at base by the rather long marcescent sheaths; internodes 3, the two upper finally much exceeding their sheaths. Sheaths closely embracing the culm, glabrous. Ligule 1.5 to 3 mm. long, somewhat narrowed to the broad, truncate or rounded apex, firm, glabrous. Blades 5 to 20 cm. long, 2.5 mm. or less wide, stongly involute, filiform toward apex, erect, thick, scabrous on the margins and nerves above, glabrous beneath. Panicle 6 to 9 cm. long, 0.5 to 1 cm. wide, linear to oblong-lanceolate, acutish, erect, strict, strongly interrupted toward base; rachis stout, straight, glabrous below, somewhat scabrous above, the lower internodes comparatively elongated, the lowest 1 to 2 cm. long; branches short, stout, appressed, densely flowered, not strongly flexuous, rather sparsely scabrous, the lower primary branches mostly in 3's, the longest 1.5 to 2 cm. long. Spikelets about 4 mm. long. Empty glumes ovate to ovate-lanceolate, acute, not strongly keeled, sparsely hispidulous on the keels, otherwise nearly glabrous, firm, thickish, almost chartaceous, dark red-purple at least on the edges and tip, equal in length or the first slightly longer. Flowering glume about 3.5 mm. long, slightly shorter than the second empty glume, broad, ovate-oblong, broadly truncate, usually minutely 4-dentate with rounded teeth, firm membranous with thinner edges and tip, minutely scabrous on the back; awn attached from one-third to one-half above the base, not nearly equaling the glume, slender (or occasionally rather stout), straight, erect, minutely scabrous. Palea two-thirds to three-fourths as long as the flowering glume, much narrower, oblong, bidentate with obtuse teeth. Anthers nearly 2 mm. long. Callus-hairs rather copious, rather stiff, bright-white, the longer one-third shorter than to nearly equaling the flowering glume. Prolongation of the rachilla, with its hairs nearly equaling the flowering glume.

Labrador.

Type specimen in the United States National Herbarium, collected at Bonne Esperance, Labrador, by J. A. Allen (18), July 29, 1882.

Specimens examined.—*Labrador:* Bonne Esperance (J. A. Allen 18), 1882; Fox Harbor, lat. 52° 22' (J. A. Allen), 1882.

Related to *C. hyperborea*, differing in its small size, slender, much interrupted panicle, thicker nearly glabrous empty glumes, and short awns.

37. **Calamagrostis hyperborea** Lange, Fl. Dan. **50**: t. 3 (1880); Consp. Fl. Groenl., 160 (1880). *C. stricta robusta* Vasey in Rothr.; Wheeler Rep. **6**: 285 (1878), not *C. robusta* C. Muell. *C. robusta* Vasey, Monog. Grasses U. S., Contr. U. S. Nat. Herb. **3**: 82 (1892).

Greenland to Alaska, south in the mountains to Vermont, Colorado, Arizona, and California.

Type specimen collected at Igaliko, near Julianehaab, southern Greenland, by I. Vahl.

Specimens examined.—*Greenland:* Kingua, Tunugdliarfik Fjord, (Rosenvinge), 1888. *Labrador:* (Waghorne 17417 H. G. S. C.), 1892. *Newfoundland:* Grand Lake, (Waghorne 43), 1896. *Quebec:* Bescie River, Anticosti Island, (Macoun 40, 17409 H. G. S. C.), 1883. *Ontario:* Northeast coast Lake Superior, (Macoun 158), 1869. *Rupert Land:* Lake Mistassini, (J. M. Macoun 47, 17410 H. G. S. C.), 1885. *Vermont:* Willoughby Lake, (W. Boott), 1862. *Manitoba:* Brandon, (Macoun 13112 H. G. S. C.), 1896. *Saskatchewan:* (Bourgeau), 1857–1859. *Montana:* Deep Creek, altitude 1,368 meters (Scribner 359), 1883; Fort Logan, Belt Mountains, (Scribner 365a), 1883; (Tweedy 1020), 1886; Townsend, (Shear 393, 398, 406; Rydberg 2151), 1895. *Wyoming:* Fort Bridger, (Porter), 1873; East Fork, Yellowstone Park, altitude 2,432 to 2,736 meters, (Tweedy 583), 1885; (Knowlton), 1888. *Colorado:* Twin Lakes, (Wolfe 1099, 1100), 1873, type of *C. stricta robusta* Vasey; Democrat Mountain, Georgetown, altitude 2,500 meters, (Jones 472), 1878; Steamboat Springs, Routt County, (Eastwood 6½), 1891; Georgetown, (Shear 646), 1895. *Alberta:* Morley, (Macoun 55), 1885; Banff, (Macoun 11451 H. G. S. C.), 1891. *Idaho:* Wheeler's expedition, 1871. *Utah:* Lookout Mountain Basin, (H. Engelmann), 1858–59; Fish Lake, altitude 2,736 meters, (Jones 5785), 1894. *Arizona:* Willow Springs, (Palmer 616), 1890. *Alaska:* Unalaska, (Kellogg 154), 1871–72. *Northwest Territory:* Fort Pelly Banks, (Dawson 97, 17405 H. G. S. C.), 1887. *British Columbia:* Spences Bridge, (Macoun 17400 H. G. S. C.), 1889; Shuswap Lake, (Macoun, 17401 H. G. S. C.), 1889; Deer Park, Lower Arrow Lake, (Macoun 171041 H. G. S. C.), 1890; Ainsworth, Kootanie Lake, (Macoun 17406), 1890. *Washington:* Cascade Mountains (Dr. Cooper). *Oregon:* Union County, (Cusick), 1879. *California:* Humboldt County, (Kellogg and Harford 1090), 1868–69.

Variable in size of the spikelets, comparative length of the glumes, length and position of the awn, length of the callus hairs, etc., but rather constant and well defined in aspect and in the characters of the organs of vegetation. An imperfect specimen from Alaska, collected by Applegate, apparently referable to this species, has a rather loosely flowered panicle, spikelets fully 6 mm. long and long-acuminate empty glumes. It may possibly be a hybrid with *C. langsdorffii.*

CALAMAGROSTIS HYPERBOREA STENODES Kearney, var. n.

Low, usually about 4 dm. high, with strongly cæspitose, slender, rigid culms, closely enveloped at base by the marcescent sheaths; narrow, strongly involute, rather rigid leaf-blades; strict, spike-like panicles 5 to 10 cm. long and about 1 (sometimes only 0.5) cm. wide; smaller spikelets (mostly 3 to 3.5 mm. long), usually less scabrous empty glumes.

Assiniboia to Colorado.

Type specimen in the United States National Herbarium, collected by F. E. Clements (206), Marshall Pass, Saguache County, Colo., altitude 3,314 meters, 1896.

Specimens examined.—*Assiniboia;* Park Beg, (Macoun 13101, H.G. S. C.), 1896. *Montana:* (F. W. Anderson). 1889; Lima, (Rydberg 2318, 2319), 1895; East Gallatin swamps, altitude 1,520 meters, (Rydberg, 3169), 1896. *Colorado:* Marshall Pass. (Clements 206), 1896; Alamosa, Conejos County, altitude 2,280 meters, (T. A. Williams 2107, Shear 869, (Clements 161), 1896; South Park, (Wolf 581, 1098), 1873.

Approaches some forms of *C. neglecta* in its slender culms, narrow, strongly involute leaf-blades and less scabrous empty glumes, but differs in its harder texture, more rigid habit, and thicker glumes.

CALAMAGROSTIS HYPERBOREA ELONGATA Kearney, new name.
Deyeuxia neglecta robusta Vasey: Macoun Cat. Can., Pl. 4: 206 (1888).

Less strongly cæspitose and less rigid than *C. hyperborea*, with fewer innovations; taller (7 to 12 dm. high) culms, less closely enveloped at base by the marcescent sheaths and with usually 4 internodes; longer (sometimes 6 dm. long), laxer, not rarely flattened leaf-blades; longer (10 to 20, usually 12 to 15 cm. long), often more interrupted, but sometimes very dense panicle with the longest branch sometimes 6.5 cm. long; usually smaller spikelets (3 to 4, commonly 3.5 mm. long); and often less pointed empty glumes.

Ontario to British Columbia, south to Pennsylvania, Michigan, Colorado, and California.

Type specimen in the United States National Herbarium, collected by P. A. Rydberg (1494), Plummer Ford, on the Dismal River, Plummer County, Nebr., 1893.

Specimens examined.—*Pennsylvania:* (F. Peck). *Ontario:* Shore Lake Huron (Macoun 17395 H. G. S. C.), 1871; Elziver North Hastings (Macoun 17397 H. G. S. C.), 1878; Belleville (Macoun 55), 1878. *Michigan:* Isle Royale (Porter) 1865; Thunder Bay Island, Alpena County (Wheeler), 1895. *Wisconsin:* Shore Lake Michigan (Schuette), 1887; valley Wisconsin River, Merrill (Cheney 2799), 1895. *Minnesota:* Fort Snelling (Jarvis); St. Cloud (Campbell), 1887. *Manitoba:* Lake Winnipeg (Richardson); Brandon (Macoun 13112 H. G. S. C.), 1896. *North Dakota:* Sheyenne River prairies (Nicollet), 1839; Willow City, Bottineau County, altitude 456 meters (Brannon 76), 1896. *South Dakota:* Hot Springs, Black Hills, altitude 1,064 meters (Rydberg 1128, 1129), 1892; Brookings, Brookings County, altitude 425 meters (Wilcox 62), 1896; Aberdeen (Griffiths 95), 1896. *Nebraska:* Norway, Middle Loup River, Thomas County (Rydberg 1409 in part), 1893; Mullen, Middle Loup River, Hooker County (Rydberg 1409 in part, 1557) 1893; Plummer Ford, Thomas County (Rydberg 1494), 1893; Thedford, Dismal River, Thomas County (Rydberg 1426), 1893; Central City (Shear 266, Rydberg 2008), 1895; North Platte (Shear 275, Rydberg 2022), 1895. *Northwest Territory:* (J. M. Macoun 17396 H. G. S. C.), 1883. *Assiniboia:* Plains (Douglas 239, 240); Indian Head (Macoun 13100 H. G. S. C.), 1895. *Saskatchewan:* Carlton (Macoun 17367 H. G. S. C.), 1875; Prince Albert (Macoun 13108), 1896. *Montana:* Tenderfoot Creek (R. S. Williams 846), 1890; Box Elder Creek (R. S. Williams 597), 1887; Manhattan (Shear 421, Rydberg 2191), 1895; Madison River (Shear 522), 1895; Castle (Rydberg 3251), 1896; swamps, East Gallatin, altitude 1,520 meters (Rydberg 3179, 3181), 1896; Sheep Creek (Rydberg 3309), 1896; Spanish Creek Basin (T. A. Williams 2072), 1896; Logan (Shear 503), 1895. *Wyoming:* Laramie (Nelson 1179), 1894; (Evermann), 1893. *Colorado:* Veta Pass (Vasey), 1886; Twin Lakes (Wolfe 801, 1101), 1873; Fort Garland, Costilla County, altitude 2,432 meters (Vasey), 1884, (Clements 145), 1896; Gunnison County, altitude 2,432 meters (Cowen 528), 1892; Florissant (T. A. Williams 2140, 2148), 1896; Colorado Springs, altitude 1,824 meters (T. A. Williams 2128), 1896. *Alberta:* Edmonston (Macoun 13, 17365 H. G. S. C.), 1872; Sand Hills (Macoun 17399 H. G. S. C.), 1879. *Utah:* Evanston, altitude 1,821 meters (Watson), 1869; Salt Lake Valley, altitude 1,300 meters (Watson 1290 in part), 1869; Ogden (Tracy 341, 342), 1887. *Nevada:* West

Humboldt Mountains, altitude 1,520 meters (Watson 1290 in part), 1867. *British Columbia:* Home Lake, Vancouver Island (Macoun 17369 H. G. S. C.), 1887; Kicking Horse Lake, altitude 1,520 meters (Macoun 8, 22, 17398 H. G. S. C.), 1890; Ainsworth, Kootanie Lake, altitude 850 meters (Macoun 23), 1890; Rogers Pass, Selkirk Mountains, altitude 1,368 meters (Macoun 17368 H. G. S. C.), 1890. *Washington:* Falcon Valley (Suksdorf 187, 188), 1885; Spokane County (Suksdorf 106), 1881; Spangle, Spokane County (Suksdorf 1099, 1100), 1884–89; (Brandegee 1170), 1883; Douglas County (Sandberg and Leiberg 325), 1893. *Oregon:* Union County (Cusick 1036), 1883; Steins Mountain (Howell), 1885; Otis Creek, Malheur County, altitude 1,100 meters (Leiberg 2331), 1896. *California:* (Lemmon).

More widely distributed than the type and usually growing at lower elevations. Eastward, intergradations with *C. inexpansa* occur. From *C. inexpansa*, however, it is usually separable by its more cæspitose habit, stouter and more rigid culms, shorter, proportionately denser and more glomerate panicle and often broader and less pointed empty glumes. It is an exceedingly variable form, and difficult to define with any degree of satisfaction.

CALAMAGROSTIS HYPERBOREA AMERICANA (Vasey) Kearney, n. comb. *Deyeuxia neglecta americana* Vasey, Macoun Cat. Can., Pl. **4**: 206 (1888). *Calamagrostis stricta* A. Gray, Proc. Am. Acad. **6**: 79 (1866), in part, not Koel. *C. americana* Scribn. Bull. Div. Agrost. U. S. Depart. Agric. **5**: 27 (1897).

Panicle usually very dense, spikelets smaller, 3 to 3.5 mm. long, empty glumes usually merely acute.

Hudson Bay region to British Columbia, south in the mountains to New England, Colorado, and Oregon.

Type specimen collected on gravel bars at Donald, Columbia Valley, British Columbia, by John Macoun (52), July 8, 1885.

Specimens examined.—*Northeast territory:* East Main River, (Ross 17376 H. G. S. C.), 1892. *Vermont:* Willoughby Lake, (H. Mann), 1863; Willoughby Mountain, (C. E. Faxon, Grout and Eggleston); Mount Mansfield, (Pringle), 1876. *Saskatchewan:* Bear Lake, (Bourgeau 119); Prince Albert, (Macoun 13104 G. S. C.), 1896. *Assiniboia:* Crane Lake, (Macoun 7481 H. G. S. C.), 1891; Cypress Hills, (Macoun 13106 H. G. S. C.), 1895. *Montana:* Rock Creek, (Scribner 361), 1883; Belt Mountains, (Scribner 360), 1883; Bozeman, (Tweedy 1020), 1886; Lima, (Rydberg 2319), 1895. *Wyoming:* Fossil Station, (Letterman 132), 1885. *Colorada:* (Patterson), 1892; Breckenridge, Summit County, altitude 2,888 meters, (Clements 390), 1896. *Utah:* Evanston, altitude 1,824 meters, (Watson 1290), 1869. *Alberta:* Banff, altitude 1,426 meters, (Macoun 21) 1891; Devils Head Lake, altitude 1,456 meters, (Macoun 22), 1891; Benton Trail, (Macoun 13105 G. S. C.), 1895. *British Columbia:* Donald, (Macoun 52), 1885, type of *C. neglecta americana* Vasey; Rogers Pass, summit Selkirk Mountains, altitude 1,369 meters, (Macoun), 1890. *Oregon:* Southeastern Oregon, (W. Gabb), 1864; Klamath Valley, altitude 1,276 meters, (Cronkhite), 1864.

The type specimen represents the extreme form with very many-flowered panicle, small spikelets (only 3 mm. long), and thinner and smoother empty glumes. Specimens from the mountains of Vermont, approach it most nearly in the characters of the spikelets. Size of spikelets is a very unreliable character in this species, however, as they sometimes vary from 3 to 4 mm. in length in the same panicle. Small specimens with rather broad and thick, merely acute empty glumes and small very dense, oblong panicles (Macoun 21c, Kootanie Lake, British Columbia), approach *C. crassiglumis* Thurb.

38. **Calamagrostis crassiglumis** Thurb.; S. Wats. Bot. Calif. **2**: 281 (1880). *Deyeuxia crassiglumis* Vasey Descr. Cat. Grasses U. S. 50 (1885). *C. neglecta crassiglumis* Beal Grasses N. Am. **2**: 353 (1896).

Vancouver Island to California.

Type specimen collected in swamps, Mendocino County, Cal., by H. N. Bolander (4766, 4787).

SPECIMENS EXAMINED.—*Vancouver Island:* Home Lake, (Macoun 123, 17372 H. G. S. C.), 1887; Lake Karmutzen, (Dawson 45, 17371 H. G. S. C.), 1885. *Washington:* Whatcom Lake, Whatcom County, (Suksdorf 1024), 1890. *California:* Mendocino, (Bolander 14), 1865; (Bolander 4766, 4787), 1866.

Allied to *C. hyperborea* from which it differs in its small size; short and comparatively wide leaf-blades; small panicle; broad ovate, merely acute, very thick and (except on the keel) obscurely scabrous empty glumes. The California specimens represent the most distinct form. Others approach *C. hyperborea* in their taller culms, smaller spikelets, and more scabrous empty glumes.

II. DESCRIPTIONS OF NEW OR LITTLE-KNOWN GRASSES.

By F. LAMSON-SCRIBNER.

PANICUM LINEARIFOLIUM Scribn., sp. n. (Pl. I.)

A slender, erect, densely cæspitose grass, 2 to 4 dm. high, with rather long, linear leaves and open panicles 5 to 8 cm. long. Culms simple or branching near the base, glabrous. Sheaths glabrous or pilose, with rather long (3 mm.), spreading hairs. Ligule a dense fringe of hairs. Leaf-blades 5 to 15 cm. long, about 4 mm. wide, very acute, scabrous on both sides and occasionally sparingly pilose. Panicle-branches solitary or in pairs, more or less spreading, flexuous, scabrous. Spikelets obovate or oblong, obtuse, 2 to 2.5 mm. long. First glume nerveless, pilose at least near the base, broadly obtuse, clasping the base of the spikelet, about 0.5 mm. long; second glume as long as the spikelet, oblong, obtuse, 7-nerved, glabrous or sparingly pilose; third glume as long as the second, obtuse, 7-nerved, glabrous or sparingly pilose, with a palea about half its length. Fruiting glume 2 mm. long, obtuse.

New England, southward to Virginia and westward to Texas.

This species is similar in habit and is very closely related to *Panicum depauperatum*, from which it is at once distinguished by its smaller and more obtuse spikelets. In *Panicum depauperatum* the spikelets are about 3.5 mm. long, and the second and third glumes are decidedly longer than the flowering glume and more prominently nerved, the first glume being distinctly 1- and occasionally 3-nerved, the second usually 9-nerved. When dry the spikelets in *P. depauperatum* have the appearance of being slightly beaked, while in *P. linearifolium* they are distinctly obtuse.

PANICUM EQUILATERALE Scribn., sp. n. (Pl. II.)

A cæspitose, glabrous species 3 to 6 dm. high, branching above with long, lanceolate leaves, diffuse panicles 7 to 10 cm. long, and erect (or geniculate at the lower nodes), smooth culms. Sheaths much shorter than the internode, smooth, pubescent, or subciliate on the overlapping margin. Ligule very short, almost obsolete. Leaf-blades 5 to 17 cm. long, 0.5 to 1.5 cm. broad, very acute, smooth beneath, minutely scabrous above, usually with a few long hairs on the margins near the base. Panicle branches spreading somewhat flexuous, pubescent on the axils, otherwise smooth. Spikelets elliptical or obovate, about 3 mm. long. First glume half the length of the spikelet, obtuse or acute, 3-nerved; second and third glumes nearly equal, slightly pubescent, 7 to 9-nerved; the third with an imperfect palea. Flowering glume about as long as the third glume, glabrous.

In pine lands, Florida (No. 1120, George V. Nash, June, 1894); scrubby hummock lands, Florida (No. 1674, George V. Nash, August, 1894).

This species belongs to the group which includes *Panicum commutatum.* The spikelets are more oblong than in that species and the leaves are narrower in proportion to their length. This species is conspicuous for its long, narrow leaves with nearly parallel margins.

PANICUM IMPLICATUM Scribn., sp. n. (Fig. 2.)

A weak, slender, hairy species, 3 to 5 dm. high, with rather short, mostly erect leaves and diffusely branching pyramidal panicles, 3 to 5 cm. long. Culms pilose with soft spreading hairs, with a glabrous ring just below the bearded nodes, soon becoming much branched. Sheaths pilose, bearded at the throat. Leaf-blades lanceolate, pilose on both surfaces, 3 to 5 cm. long, 3 to 6 mm. broad, acute. Axis of the panicle, excepting near the apex, pilose; branches spreading, very flexuous, and usually pilose near the base, otherwise glabrous. Spikelets obovate or oblong, obtuse, about 1.5 mm. long. First glume minute, hardly one fourth as long as the spikelet; second and third glumes about equal, minutely pubescent, 7-nerved. The third glume with a small palea. Flowering glume smooth and shining, about the length of the third glume. Distinguished from *P. atlanticum* by its more flexuose panicle-branches and smaller spikelets.

Low marshy ground, Cape Elizabeth, Maine. Collected by F. Lamson-Scribner, July 26, 1895.

This grass was found growing in patches of considerable extent upon marshy land near the seashore. Its reddish or purplish spikelets, panicle-branches, and upper leaf sheaths rendered these patches conspicuous by their color. The delicate and flexuous panicle-branches cause the neighboring panicles to become so entangled that individual specimens are separated with difficulty.

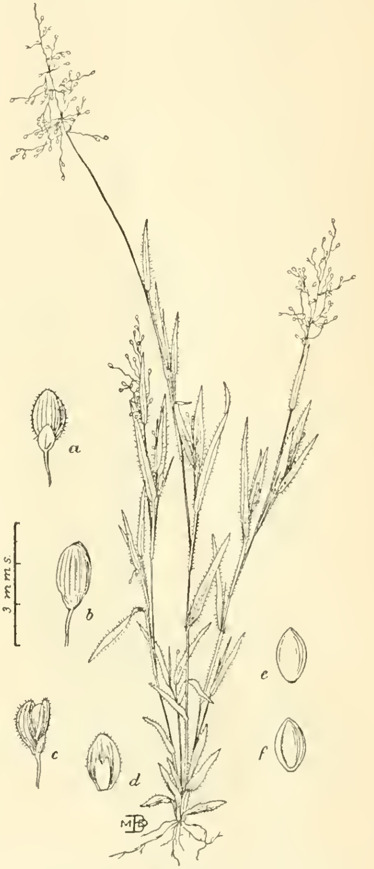


FIG. 2.—*Panicum implicatum* Scribn.; *a*, *b*, *c*, three views of the spikelet; *d*, third glume, showing small palea; *e*, dorsal view of the flowering, or fruiting, glume; *f*, anterior view of flowering glume, showing palea.

PANICUM BALDWINII. Nutt. in herb. (Fig. 3.) (*Panicum dichotomum* var. *nitidum* Chapman, Southern Flora, first edition. *Panicum nitidum* var. *minor* Vasey Contrib. from National Herbarium **3**: page 30. *Panicum ramulosum* Chapman, Southern Flora, Supplement, not Michx.)

A slender and densely caespitose, glabrous perennial 1 to 3 dm. high, much branched near the base, with short, narrow, and more or less spreading leaves, ovoid or pyramidal panicles, 2 to 4 cm. long, and minute spikelets. Sheaths much shorter than the internodes, excepting the loose basal ones, overlapping margins usually ciliate. Ligule a short, dense fringe of hairs. Leaf-blades 1.5 to 5 cm. long, 1 to 4 mm. wide, very acute, glabrous, minutely scabrous on the margins, often with a few long, marginal hairs near the base Panicle-branches capillary, flexuous, sparingly and minutely scabrous. Spikelets glabrous, ovoid or pyriform, obtuse, about 1 mm. long. First glume rarely more than one fourth as long as the spikelet, obtuse. The second and the third glumes about equal, faintly nerved. Flowering glume and palea rounded-obtuse, about the length of the second and third glumes.

Low cultivated ground, Duval County, Fla. (No. 3602, A. H. Curtiss), and moist, recently cultivated ground in Jacksonville, Fla. (No. 5588, A. H. Curtiss.)

This grass was collected many years ago by Mr. Baldwin, and specimens of it in the Herbarium of the Philadelphia Academy of Natural Sciences are ticketed *Panicum baldwinii*, Nutt., which name is here taken up.

PANICUM WRIGHTIANUM Scribn., sp. n. (Fig. 4.)

A slender, much branched, leafy perennial with smooth, delicate panicles and minute spikelets. Culms many-jointed, branched throughout, minutely pubescent. Sheaths shorter than the internodes, excepting on the more crowded branches, minutely pubescent in the type. Basal leaves crowded, ovate to ovate-lanceolate, 1 to 2 cm. long, very minutely pubescent beneath, sparingly so above. Cauline leaves 1 to 3 cm. long, 2 to 3 mm. wide, very acute, tapering from near the base, minutely pubescent below, faintly and shortly pilose above in the type. Panicle 2 to 3 cm. long, branches capillary, flexuous, the main axis minutely pubescent below, branches glabrous. Spikelets ovate-oblong to orbiculate, hardly 1 mm. long. First glume about one-third as long as the spikelet or shorter; second and third glumes minutely and densely pubescent, faintly 5- to 7-nerved, obtuse, barely equaling the smooth and shining flowering glume and palea. Third glume with a minute palea in its axil.

Cuba (No. 3463, C. Wright, 1865); in moist, open areas in pine forests near Biloxi, Miss. (No. 307, Thomas H. Kearney, October, 1896); Horn Island, Biloxi, Miss. (No. 2861, S. M. Tracy, August 20, 1891).

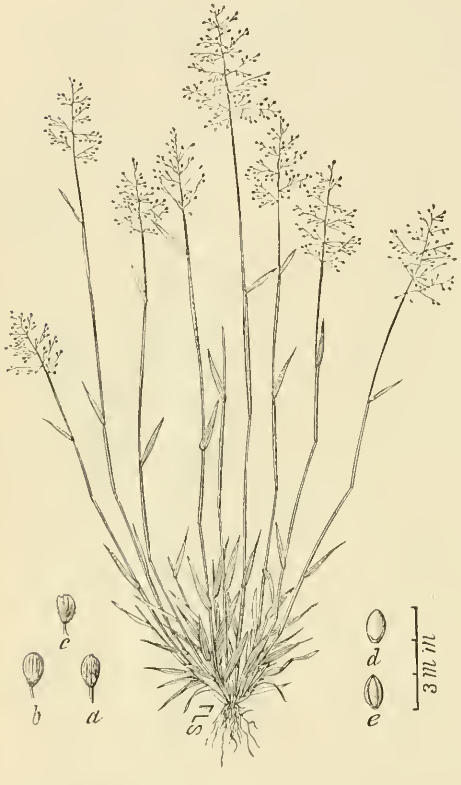


Fig. 3.—*Panicum baldwinii* Nutt. in Herb. Acad. Nat. Sci. Phila.: *a*, *b*, *c*, three views of the spikelet; *d*, flowering, or fruiting, glume seen from the back; *e*, anterior view of the fruiting glume, showing palea.

This species is closely related to *Panicum baldwinii*, but is more branching throughout. In that species the branches are mostly near the base; the culm is minutely pubescent, in *P. baldwinii* it is glabrous. It is further distinguished by the pubescence of its leaves and spikelets.

CHÆTOCHLOA LATIFOLIA Scribn., sp. n. (Pl. III.)

A branching annual, 2 to 4 dm. high, with compressed sheaths, rather broad, flat leaves and bristly panicles 4 to 8 cm long. Culms compressed, slightly scabrous, and short bearded at the nodes. Sheaths striate, scabrous, especially along the keel, papillate-pilose, villous on the overlapping margin. Ligule very short and densely ciliate-fringed with stiff hairs. Leaf-blades broadly lanceolate, cordate at the base, very acute 5 to 6 cm. long, 1 to 2 cm. broad, scabrous on both sides and especially along the narrow, cartilaginous margins, strongly pilose above and below. Branches of the panicle very short, slightly crowded, spikelets obovate, about 2 mm. long. First glume less than 1 mm. in length, 3-nerved; second glume shorter than the flowering glume, 5-nerved; outer glumes all obtuse, the third one empty. Flowering or fruiting glume about 2 mm. long, strongly convex and deeply transversely rugose excepting near the slightly apiculate apex. Palea transversely rugose and similar in texture to the flowering glume. Bristles 12 to 18 mm. long, strongly scabrous.

Growing under bushes in deep ravines, Durango, Mexico (No. 879, E. Palmer, 1896.)

This species is well marked by its comparatively short and broad leaves which are cordate at the base, and long, widely spreading bristles.

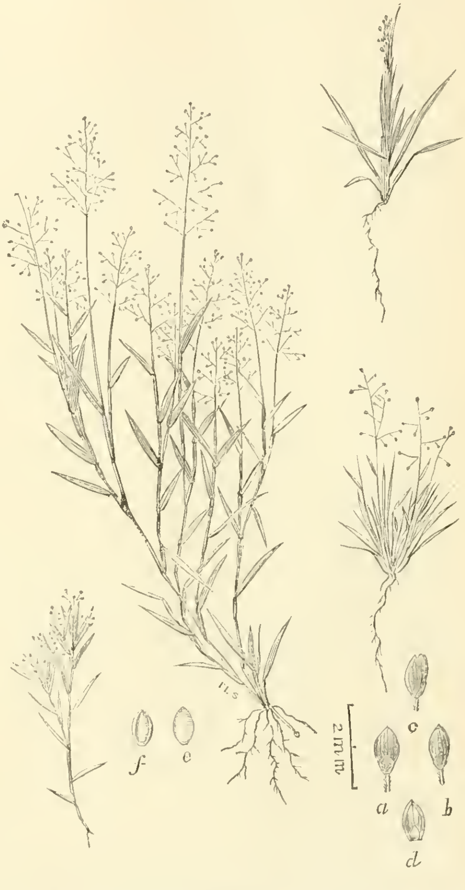


Fig. 4.—*Panicum wrightianum* Scribn.: *a*, *b*, *c*, various views of the spikelet; *d*, third glume, showing small palea; *e*, flowering, or fruiting glume, seen from the back; *f*, flowering glume, seen from the anterior side, showing palea.

STIPA WILLIAMSII Scribn., sp. n. (Pl. IV.)

A rather stout, erect perennial, 7 to 9 dm. high, with rather long, flat leaves and strict panicles, 17 to 22 cm. long. Culms sometimes geniculate at the lower nodes, pubescent at least near the nodes. Sheaths shorter than the internodes and softly pubescent, at least the lower ones. Ligule very short, auriculate. Leaf-blades 15 to 30 cm. long, 2 to 6 mm. wide, long attenuate-pointed, pubescent on the back, especially toward the base, scabrous above. Lower panicle-branches 5 to 8 cm. long, the longer ones naked below, shorter ones flower-bearing to the base. Spikelets, exclusive of the awns, about 6 mm. long. Empty glumes lanceolate, with long-acuminate hyaline tips, nearly equal and a little exceeding the flowering glume, the first 3-nerved, the second 5-nerved. Flowering glumes about 6 mm. long, with a sharp-pointed callus, 1 mm. in length, strongly pilose all over with appressed hairs and a distinct crown of hairs at the apex. Palea pilose like the glume and about one-half its length. Awn about 2.5 cm. long, once or twice geniculate and more or less flexuous, minutely scabrous throughout.

Dry soil on the west side of Big Horn Mountain, near Monument Spring, Wyo., altitude 2,200 to 2,400 meters (No. 2804, Thomas A. Williams, August 3, 1897); Rocky knolls, Little Laramie River, Wyoming (No. 2231, Thomas A. Williams, July 2, 1897); near Jefferson City, Mont. (No. 340, F. Lamson-Scribner, June 27, 1883). Named for Thomas A. Williams, assistant agrostologist.

This species has been confounded with *Stipa viridula*, from which it is readily distinguished by its longer and more acute callus and pubescent culms and sheaths. It is more nearly allied to *Stipa viridula* var. *pubescens* Vasey, from Washington State, which possesses the same character of pubescence. In that species, however, the awns are pubescent to the second bend. *Stipa viridula* var. *pubescens* Vasey is equally distinct from *S. viridula* and may be classed as a distinct species and named **S. elmeri** Piper & Brodie, under which name it has recently been distributed by Mr. Elmer. There is a *Stipa pubescens* R. Br.

STIPA NELSONI Scribn., sp. n.

A rather stout, glabrous, cæspitose perennial, 7 to 9 dm. high, with long, narrow culm leaves, and strict panicles 15 to 25 cm. long. Culms smooth; sheaths striate, smooth, the overlapping margins pilose with soft hairs. Ligule very short (less than 1 mm.), and minutely fringed on the edge, slightly auricled and pubescent on the sides. Panicle branches appressed, 4 to 5 cm. long, all excepting the longer ones flower-bearing to the base; lowermost branches sometimes 10 cm. long. Empty glumes slightly unequal, the first 9 to 10 mm. long, 3-nerved, the second a little longer and narrower, 5-nerved near the base, both glumes long acuminate-pointed, very thin and hyaline excepting the nerves, which are quite conspicuous. Flowering glumes, including the rather acute callus, 7 mm. long, clothed with soft, silky hairs, which are longest at the shortly two-toothed apex. Palea rather broad, half as long as the glume, pilose on the back, truncate at the apex or irregularly toothed. Awn about 3.5 cm. long, minutely scabrous. Anthers beardless.

Woods Landing, Albany County, Wyo., altitude 2,600 meters (No. 3963, A. Nelson, August 9, 1897); rich soil, Sheep Mountain, "common and affords considerable forage," altitude 2,400 meters (No. 2269, Thomas A. Williams, July 2, 1897.) Named for Prof. Aven Nelson.

This grass has been confounded with *Stipa viridula*, from which it is readily distinguished by its longer and more pointed callus to the flowering glume, and especially by the silvery, comose appearance of the panicle. The silvery appearance is due to the hyaline character of the outer glumes. The details of the spikelets are more nearly those of **Stipa vaseyi** Scribn., new name (*Stipa viridula robusta* Vasey, not *S. robusta* Nutt.), but in that species the outer glumes are quite firm in texture, and minutely but distinctly scabrous all over the back. In this species the glumes are perfectly smooth on the back, and the awns are more than twice as long as in *Stipa vaseyi*.

STIPA MINOR (Vasey) Scribn. (*S. viridula* var. *minor* Vasey Contr. U. S. National Herbarium **3**: page 50.)

A densely cæspitose, erect, glabrous perennial, 4 to 6 dm. high, with narrow leaves and densely flowered, usually purplish panicles 5 to 12 cm. long. Culms smooth or very minutely pubescent below the nodes. Sheaths smooth. Ligule very short, slightly auricled, broader than the base of the leaf-blade. Leaf-blade 10 to 30 cm. long, 2 to 3 mm. wide, with very long attenuate-involute tips, scabrous on the margins, otherwise smooth. Leaves of the innovations involute and almost filiform, at least when dry. Spikelets 6 to 7 mm. long. Empty glumes lanceolate, sharply acuminate-pointed, 3-nerved near the base, the first slightly broader and longer than the second and less distinctly nerved. Flowering glume, including the short callus, about 4 mm. long, thinly pilose all over with a crown of hairs at the distinctly 2-toothed apex. Palea about three-fourths as long as the glume. Awn once or twice geniculate, about 18 mm. long, very minutely scabrous.

Moist mountain sides, altitude 3,200 meters. Robinson, Summit County, Colo. (No. 1052, C. L. Shear, August, 1896); Buena Vista, Chaffee County. Colo., altitude 3,500 meters (No. 1006, C. L. Shear, August, 1896); Sweetwater County, Wyo., altitude 2,600 meters (No. 3828, Aven Nelson, July 23, 1897); Beaver Canyon, Idaho (No. 301, C. L. Shear, June 27, 1895); North Park, Colo. (C. S. Crandall, Sept. 5, 1890); Kelso Mountain, near Torrey Peak, Colo., altitude 3,800 meters (G. W. Lettermann, August, 1885).

In collections this very well-marked and alpine species has often been referred to *S. viridula*.

STIPA TWEEDYI Scribn., n. n. (*Stipa comata intermedia* Scribn. Bot. Gaz. **11**, page 171, not *Stipa intermedia Trin.*)

A densely cæspitose, glabrous, and often glaucous perennial 6 to 9 dm. high, with narrow, usually more or less involute leaves and lax, nodding panicles, 20 to 30 cm. long. Sheaths smooth, lower ones generally glaucous. Ligule about 5 to 7 mm. long, broader than the leaf-blade. Leaves of the culm 10 to 15 cm. long, 3 to 5 mm. wide, minutely strigose-scabrous above, smooth beneath. Leaves of the innovations narrower and longer. Base of the panicle usually included in the upper-leaf sheath, its branches solitary or in pairs, naked below. Outer glumes 2 to 2.5 cm. long, the first 3-nerved, the second a little longer than the first and 5-nerved, both with long attenuate-pointed hyaline tips. Flowering glume, including the rather long densely hairy and very acute callus, 12 to 15 mm. long, thinly pilose hairy, apex entire. Awn about 100 mm. long, twice geniculate, straight beyond the second geniculation or only slightly flexuous, scabrous throughout, very minutely pubescent toward the base. Palea as long as the glume, rather broad, pilose on the back. Anthers bearded at the tips.

Junction Butte, Yellowstone Park, altitude 1,800 meters (No. 610, F. Tweedy, 1881-1885); Sheep Mountain, Laramie, Wyo., "common on the plains and mountain slopes," altitude 2,500 meters (No. 3297, Aven Nelson, July 3, 1897); Dry hillsides, Evanston, Wyo. (No. 2438, T. A. Williams, July 10, 1897); Tucson, Ariz. (No. 731, J. W. Toumey); Gravelly soil along railroad track, Veta Pass, Colo., altitude 2,650 meters (No. 821, C. L. Shear, July 15, 1896).

This species has been confounded with *Stipa comata*, which it resembles in habit, but in that species the flowering glume, including the callus, is about 8 to 9 mm. long; the awn is more slender, longer, and distinctly flexuous or more or less curled beyond the geniculations.

MUHLENBERGIA PALUSTRIS Scribn., sp. n.

A very slender, much branched perennial, with numerous short and narrow leaves and slender, strict panicles. Culms almost threadlike, reclining or ascending, 3 to 6 dm. long, smooth. Sheaths smooth for the most part shorter than the internodes. Ligule very short, barely 0.5 mm. long, ciliate on the margin. Leaf-blades 2 to 4 cm. long, 2 to 3 mm. broad, minutely scabrous on the upper surface, at least near the base. Panicles terminating the culm or the branches, 5 to 10 cm. long; branches appressed, the longer lower ones 2 to 3 cm. in length, scabrous. Spikelets 2 to 3 mm. long (about 2.5) exclusive of the awn. Empty glumes subequal or the first a little shorter than the second, about 0.8 mm. long. Flowering glume 2.5 mm. long, linear-lanceolate, scabrous on the back, especially toward the apex, barbate at the base or on the callus with rather long hairs. Awn slender, straight, or slightly flexuous, 5 to 6 mm. long. Palea about as long as its glume.

Swampy grounds, Brightwood, D. C. (E. S. Steele, September, 1896). Closely related to *Muhlenbergia diffusa*, from which it is readily distinguished by its larger and nearly equal empty glumes.

SPOROBOLUS PALMERI Scribn., sp. n. (Pl. V.)

A densely cæspitose, glaucous perennial, 3 to 5 dm. high, with narrow, spreading leaves and diffuse panicles 20 to 30 cm. long. Sheaths smooth, striate, crowded below, bearded at the throat. Ligule a short, dense fringe of hairs. Leaf-blades 5 to 10 or 12 cm. long, 2 to 4 mm. wide, rather rigid, very sharp-pointed, strongly involute when dry and more or less flexuous, smooth and glaucous, especially on the upper surface the whole plant more or less glaucous. Panicle-branches finely spreading, solitary, very smooth, pedicels spreading, somewhat flexuous, primary branches rather rigid, spikelets about 3.5 mm. long. Outer glumes obtuse, the first about 2 mm. long, the second 2.5 mm. long, the flowering glume rather broad-ovate or oblong, obtuse, about 3.2 mm. long, 3-nerved. Palea with very broad margins, equaling or slightly exceeding the flowering glume.

In alkali bottoms, growing in rather dense bunches, near the city of Durango, Mexico, altitude 1,850 meters (No. 180, E. Palmer, June, 1896). The species is named for the collector, Dr. Edward Palmer.

SPOROBOLUS THURBERI Scribn., sp. n. (Fig. 5.) *Vilfa filiculmis* Thurb. in Bot. Mex. Boundary Survey ined.

A slender, very much branched and leafy perennial, 15 to 25 cm. high from creeping rootstocks, with contracted, linear, long exserted panicles 3 to 5 cm. long. Lower sheaths short and crowded, the upper shorter than the internodes; ligule 1 mm. long, lacerate. Leaf-blades 12 to 16 mm. long, convolute, setaceous, rigid, and widely spreading or arcuate, mucronate-pointed. Spikelets straw-colored, 4 to 5 mm. long. Empty glumes broadly lanceolate, acute, about one-third shorter than the third or flowering glume, which is pilose for half its length and mucronate-pointed. Palea very acute, strongly two-nerved, pilose on back, equaling the flowering glume.

Camp 49, Plaza Larga, September 21, 1853, Bigelow. Related to *Sporobolus utilis* but quite distinct from that species, especially in the characters of the spikelets.

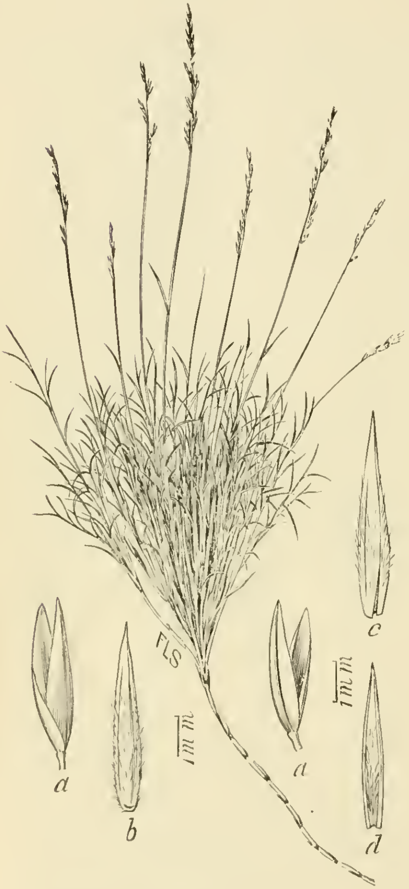


FIG. 5.—*Sporobolus thurberi* Scribn.: *a*, *a'*, empty glumes; *b*, floret, seen from the back; *c*, flowering glume; *d*, palea.

SPOROBOLUS SIMPLEX Scribn., sp. n. (Fig. 6.)

A low, densely cæspitose, leafy annual, 5 to 15 cm. high with slender, smooth culms, very short lower internodes, flat leaves and linear panicles 2 to 4 cm. long. Lower sheaths loose, overlapping. Ligule hyaline, 2 to 3 mm. long, decurrent. Leaf-blades 0.5 to 1.5 cm. long, 1 to 2 mm. broad, scabrous on the margins and on the nerves above, very rough near the rigid apex. Axis of panicle rather rigid, and with the branches scabrous. Spikelets 2 to 2.3 mm. long. Empty glumes less than 1 mm. in length, broadly obtuse or truncate and occasionally minutely erose-dentate, minutely scabrous on the back above. Flowering glumes 3-nerved, mucronate-pointed or subaristate, scabrous above. Palea a little shorter than the glume.

Type specimen 2411, P. A. Rydberg, Georgetown, Colo., August 19, 1895. H. N. Patterson collected the same form in the same region in 1885. A rigid and apparently a perennial form of this species was collected by C. G. Pringle near Summit Valley in the Sierra Nevada Mountains, California, September 19, 1882, and distributed as *Sporobolus gracillimus*, with which the species is most closely allied. It is distinguished from *S. gracillimus* by its broader, more rigid leaves, more scabrous panicle-branches, and generally stouter habit of growth. It has heretofore been referred to *Sporobolus gracillimus*. No. 1041, C. L. Shear, from Twin Lakes, Colo., August 23, 1896, belongs to *Sporobolus simplex*.

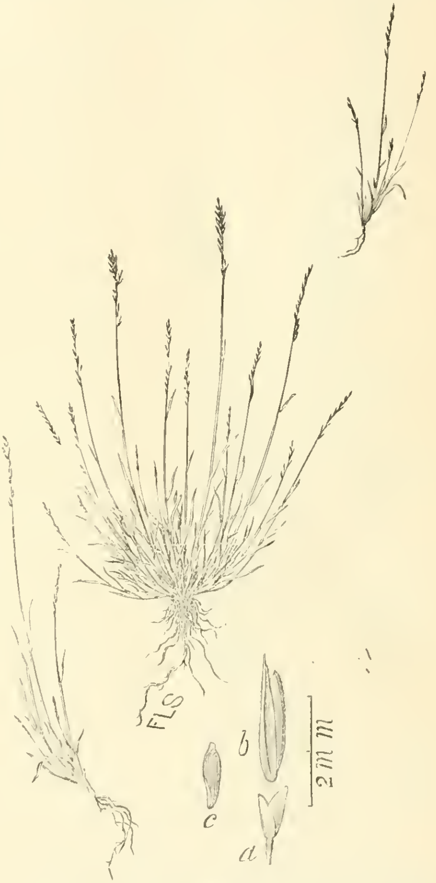


FIG. 6.—*Sporobolus simplex* Scribn.: *a*, empty glumes; *b*, spikelet, empty glumes removed; *c*, grain.

AGROSTIS PALUDOSA Scribn., sp. n. (Fig. 7.)

A low, densely caespitose perennial, 10 to 15 cm. high. with soft, narrow leaves; narrow, rather densely flowered panicles, 3 to 5 cm. long. Sheaths smooth, the lower thin and somewhat scarious. Ligule elongated, about 2 mm. long. Leaf-blade soft and flaccid, at least the lower ones, minutely scabrous on the margins, otherwise smooth. Panicle-branches scabrous. Spikelets 3 mm. long. Empty glumes ovate, lanceolate, acute, equal, subciliate, scabrous on the keel excepting near the base. Flowering glume nearly 3 mm. long, rather broadly obtuse, very minutely punctate-scabrous on the back excepting near the tip, awnless. Palea about 0.5 mm. long, hyaline. Callus very shortly barbate on the sides.

Blanc Sablon, Labrador (Rev. A. Waghorne, September 25, 1893). Apparently a well-marked species, allied to *Agrostis varians*, but with much larger spikelets.

TRISETUM ARGENTEUM Scribn., sp. n. (Fig. 8.)

A slender, erect perennial with smooth culms, 5 to 7 dm. high, very minutely scabrous sheaths and leaves, and narrow, silvery-gray or purplish panicles, 10 to 20 cm. long. Culms minutely pubescent at the nodes and otherwise glabrous. Sheaths minutely pubescent, especially those of the sterile shoots. Ligule about 2 mm. long with a broad, erose or lacerate apex. Leaf-blades linear, 10 to

15 mm. long, 3 to 4 mm. wide, long acuminate-pointed, minutely scabrous on the under surface, glabrous above. Panicles rather densely flowered, the main axis and primary branches minutely pubescent; the longer branches 2 to 4 cm. in length, naked below, the shorter ones flower-bearing to the base. Spikelets 4 to 5 mm. long, 1- to 2-flowered, with a hairy prolongation of the rachilla beyond the second flower. When 1-flowered, this prolongation of the rachilla may bear an imperfect glume and awn. Empty glumes unequal, acuminate-pointed. The first 1-nerved and about 3 mm. long; the second 3-nerved and about 4 mm. long or nearly equaling the spikelet. Flowering glumes minutely scabrous on the back. The first about 4 mm. long, narrowly lanceolate, acute or slightly 2-cleft at the apex, awned below the apex. Awn straight and 1 to 3 mm. long. Palea hyaline, nearly as long as the glume, arcuate below, 2-toothed at the apex. Callus shortly barbate, joints of the rachis pilose-hairy.

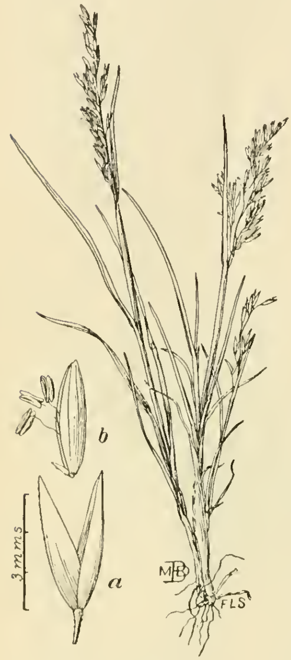


FIG. 7.—*Agrostis paludosa* Scribn.: *a*, empty glumes; *b*, flowering glume, showing a small palea and three stamens.

Among rocks, Las Animas Canyon below Silverton, Colo. (No. 1214, C. L. Shear, August 4, 1897), altitude 2,700 meters. An elegant grass and apparently a well-marked species, nearly related to *T. wolfii* Vasey (fig. 9), which is distinguished by its shorter, narrower leaves, perfectly smooth culms and sheaths, smaller and more loosely flowered and less compressed spikelets and longer hairs on the joints of the rachilla. *T. wolfii* was collected at Twin Lakes, Colo., by John Wolf in 1873, and specimens exactly resembling the type were collected in willow thickets, Twin Lakes, Colo., by Mr. Fred E. Clements (333), August 20, 1896. These are the only specimens in the National Herbarium referable to this species, which is fairly well figured in Bot. Wheeler Expedition, plate 27 (1878).

Trisetum argenteum is distinguished from the closely allied *T. montanum* Vasey by its shorter, straight awns, which are inserted higher up on the glume.

Trisetum muticum (Boland.) Scribn. (fig. 10). *Trisetum subspicatum* var. *muticum* Boland. in herb. Thurb. in S. Wats. Bot. California **2**:296, *Trisetum wolfii* Vasey (in part). *Trisetum brandegei* Scribn. in Bull. Torr. Bot. Club **10**:64. This species is in every way stouter than *Trisetum wolfii*, with broader and longer leaves and larger and more densely flowered panicles. The outer glumes are more nearly equal, and the flowering glumes firm in texture, with rougher surface. *Trisetum brandegei* was based on a robust form of the species.

Trisetum melicoides (Mx.), Scribn., Coult. Bot. Gaz. 1887, p. 167 (*Aira melicoides* Michx., *Graphephorum melicoides* Beauv.) belongs in this group of species.

ZEUGITES PRINGLEI Scribn., sp. n. (Pl. VI.)

A slender, branching perennial, 3 to 6 dm. long, with broadly ovate, acute, petiolate leaves and capillary panicles about 8 to 10 cm. long. Culms and sheaths glabrous, smooth. Ligule 1 to 2 mm. long. Leaf petioles very slender, about 1 cm. in length. Leaf-blades glabrous, 3 to 4 cm. long and 2 cm. broad, rounded at the base, transverse veins conspicuous on the under surface. Branches of the panicle spreading or divergent, very slender. Spikelets 2- to 3-flowered, about 7 mm. long. Outer glumes about 2 mm. long, equal in length; the first 5-nerved, the second 3-nerved with transverse veins. Apex irregularly toothed, the teeth sometimes short awn-pointed. Glumes of the female floret 4 mm. long, reaching the base of the first staminate floret, terminating in a slender awn, 10 to 12 mm. in length. Staminate floret about 3 mm. long.

Wet mountain canyons near Cuernavaca, State of Morelos, Mexico (No. 7771, C. G. Pringle, November 6, 1896), altitude 1,900 meters.

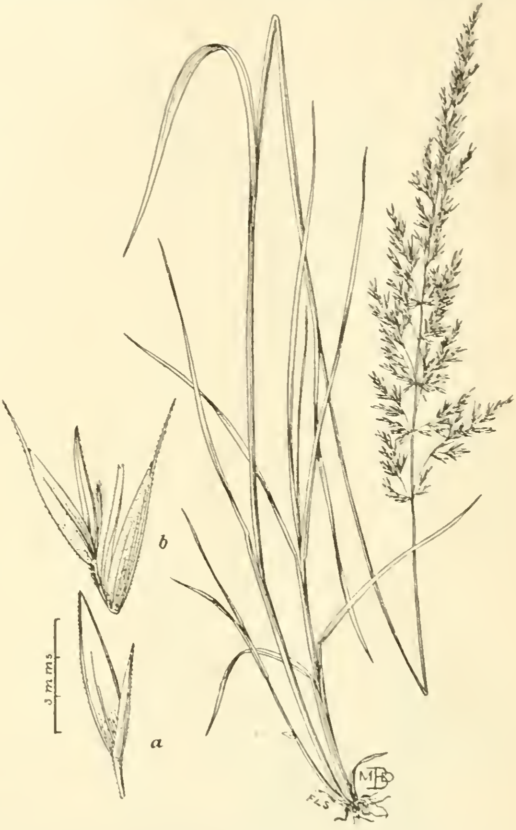


FIG. 8.—*Trisetum argenteum* Scribn.: *a*, empty glumes; *b*, two florets, seen from the side.

In habit this species resembles *Zeugites mexicana* Trin., but is at once distinguished by its broader leaves, and awned glumes of the female florets. I have been unable to compare this species with *Zeugites americana* Willd., but it differs from the description of that species in its much longer awn. The awn of *Zeugites americana* of the West Indies is described as being only about one-half the length of the glume, while in *Z. pringlei* the straight awn is 2 to 3 times the length of the glume.

ERAGROSTIS VISCOSA Scribn., sp. n. (Pl. VII.)

A slender, somewhat wiry perennial with erect, many-jointed culms, 3 to 4 dm. high, narrow, involute (at least when dry) leaves and diffuse panicles 6 to 12 cm. long. Sheaths mostly longer than the internodes and overlapping, viscid, pilose along the margins, at least near the apex, and bearded at the throat. Ligule a very short fringe of hairs. Leaf-blades 4 to 10 cm. long, 2 to 4 mm. wide, strongly involute when dry, scabrous above, smooth beneath. Axis of panicle and its branches viscid, somewhat rigid, the branches finally spreading or divergent. Spikelets 3 to 4 mm. long, 3- to 5-flowered, appressed to the rachis, and excepting the terminal ones, nearly sessile. Empty glumes acute, subequal, scabrous on the keels; flowering glumes narrowly oblong, obtuse, strongly 3-nerved and scabrous on the keels. Palea a little shorter than the glume, arcuate below, aculeolate-scabrous on the keels above.

Midland, Tex. (J. G. Smith, August 2, 1897). Laredo, Tex. (Mrs. Anna B. Nickels). It is remarkable for being viscid throughout.

POA CAPILLARIS Scribn., sp. n. (Fig. 11.)

A slender, erect, densely-cæspitose perennial, 3 to 4 dm. high, with almost capillary and flexuous basal leaves and long-exserted densely-flowered panicles, 3 to 5 cm.

long. Leaves of the innovations 3 to 6 cm. long, about 1 mm. wide, scabrous above, smooth beneath. Leaves of the culm scabrous above, usually 2, 2 to 4 cm. long, about 2 mm. wide. Ligule hyaline 2 mm. long. Axis of the panicle and its branches scabrous, the longer lower branches 1.5 to 2 cm. long, naked below. Spikelets 3- to 5-flowered, compressed, 7 to 10 mm. long. Empty glumes 4 to 5 mm. long, broadly lanceolate or ovate, acute, 3-nerved, scabrous on the keel. First flowering glume 4 to 5 mm. long, scabrous on the keel and minutely scabrous all over and slightly hairy near the base, with very short appressed hairs. Palea as long as the glume, keels strongly ciliate excepting near the base, pubescent between the keels, 2-toothed. Joints of the rachilla 1 mm. long, smooth.

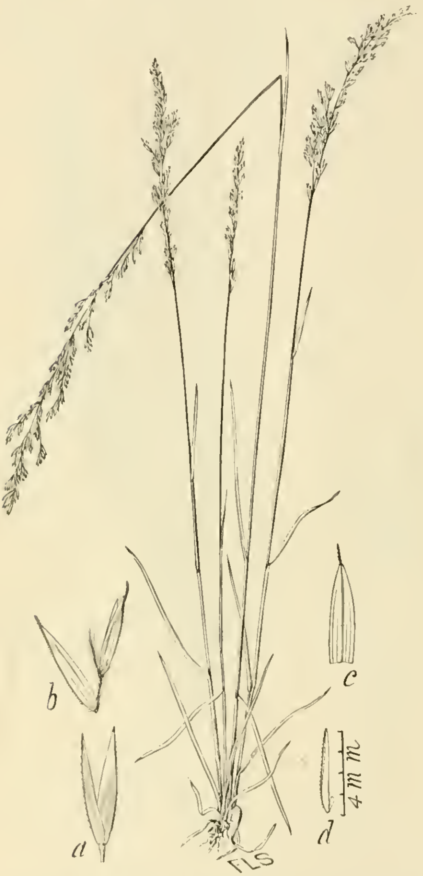


FIG. 9.—*Trisetum wolfii* Vasey: *a*, empty glumes; *b*, two florets without the empty glumes, seen from the side; *c*, dorsal view of flowering glume; *d*, palea.

Potrero, Cal., April 9, 1892. Specimens received from the herbarium of the California Academy Sciences. Name of collector not given. Allied to *Poa sandbergii*, from which it may be separated by its more densely-flowered panicles, nearly scabrous flowering glumes and smooth rachilla. In *Poa sandbergii* the flowering glumes are villous on the lower half, as are the joints of the rachilla.

POA JUNCIFOLIA Scribn., sp. n. (Pl. VIII.)

A rather rigid, erect, glabrous perennial, 1.5 to 3 dm. high, with firm, erect leaves and strict panicles 5 to 8 cm. high. Lower sheaths loose, striate, glabrous. Leaves of the innovations about 5 cm. long, involute, scabrous on the margins near the apex. Culm leaves 2 to 3, 2 to 5 cm. long, 1 to 2 mm. wide. Ligule about 2 mm. long, rounded-obtuse, entire. Panicle-branches erect, the longer lower ones 2 to 3 cm. long, naked below, scabrous. Spikelets 3- to 5-flowered, 5 to 6 mm. long, somewhat compressed. Empty glumes broad, ovate-obtuse, sometimes acute, subequal, 3 to 4 mm. long, 3-nerved, with broad, scarious margins, scabrous on the keel near the apex. Flowering glumes minutely scabrous on the back with occasionally a few very short hairs near the base. The first one, 3 to 4 mm. long, obtuse. Palea a little shorter than the glume, subciliate-scabrous along the keels excepting near the apex.

Point of Rocks, Sweetwater County, Wyo. (No. 3721, Aven Nelson, July 13, 1897). Related to *Poa arida* Vasey, from which it is distinguished by its glabrous flowering glumes. In *P. arida* the flowering glumes are shorter, relatively broader, and densely villous towards the base.

POA HANSENI Scribn., sp. n. (Pl. IX.)

A densely cæspitose, slender, erect, glabrous, perennial, 2 dm. high, with narrow, chiefly radical and rather firm leaves and long-exserted strict panicles about 4 cm. long. Leaves of the innovations intravaginal 5 to 8 cm. long, less than 1 mm. in width, smooth. Culm leaves 2, 1 to 3 cm. long. Sheaths and leaves glabrous. Ligule very short, obtuse. Panicle branches erect, the longer lower ones 1 to 2 cm. long. Spikelets 4 to 5 mm. long, compressed, 2- to 3-flowered. Empty glumes subequal, 3 to 4 mm. long, acute, scabrous on the keel excepting near the base, minutely scabrous all over, as are the flowering glumes. Flowering glumes lanceolate, acute, scabrous on the keel excepting near the base, hairs none. Palea about the length of the glume with scabrous keels. Callus naked Silver Lake, Amador County, Cal. (No. 605, George Hansen, June 27, 1892). Related to *Poa pringlei*, but readily distinguished by its smaller spikelets. The species is named for Mr. George Hansen, the collector.

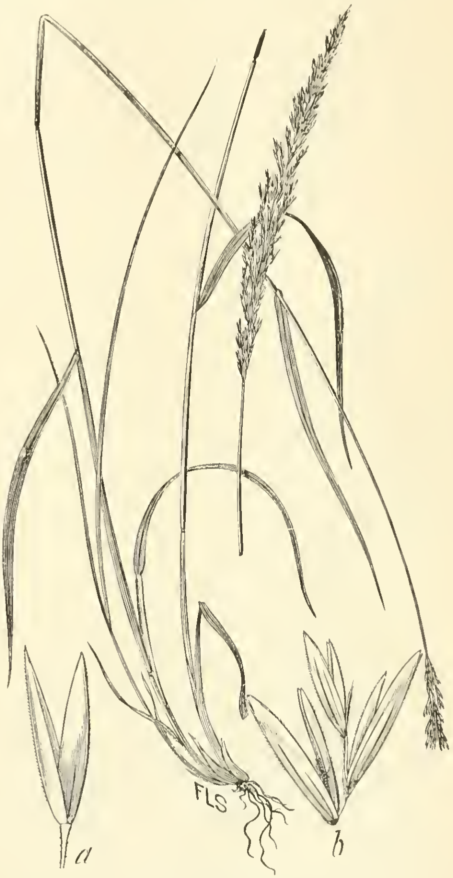


FIG. 10.—*Trisetum muticum* (Boland.) Scribn.: *a*, empty glumes; *b*, three florets, seen from the side, empty glumes removed.

POA ATROPURPUREA Scribn., sp. n. (Pl. X.)

A slender, somewhat wiry grass 3 to 4 cm. high from a creeping rootstock, short and rather rigid basal leaves, and densely flowered dark purple panicles, 2 to 4 cm. long. Glumes smooth, usually purplish above. Sheaths smooth, striate. Ligule 1 to 1.5 mm. long, rounded-obtuse or truncate, entire. Leaf-blades of the sterile shoots narrow and involute, at least when dry, 5 to 8 cm. long; those of the culm somewhat broader, glabrous, arcuate, 2 to 8 cm. long, the upper ones much shorter. Panicle long-exserted, the appressed branches densely flowered, the longer ones naked below. Spikelets ovate-obtuse, 3- to 5-flowered, 3 to 4 mm. long, about 2 mm. broad. Axis of the rachilla breaking up, glumes firm in texture, the outer ones nearly equal, ovate-obtuse, about 2 mm. long. First flowering glume 2 to 2.5 mm. long, oblong-ovate, obtuse, and glabrous. Palea about as long as its glume, narrowly scabrous on the keel, grain nearly as long as the palea which incloses it.

San Bernardino Mountains, San Bernardino, Cal. (No. 2968, S. B. Parish, June 18, 1894), altitude 1,900 meters; Bear Valley, San Bernardino Mountains (No. 3696, S. B. Parish, June, 1895).

A very well marked species, characterized by rigid basal leaves and densely flowered dark-purple panicles, and especially by its rigid glumes and naked flowering glumes. Distributed as *Poa unilateralis*, with which it has no resemblance excepting in its densely flowered panicle.

POA LONGEPEDUNCULATA Scribn., sp. n. (Pl. XI.)

A slender, erect, and rather densely cæspitose grass, 5 to 7 dm. high, from short, creeping rootstocks, with narrow basal leaves and long-exserted and densely flowered panicles, 5 to 7 cm. long. Culms smooth, excepting just below the panicle where they are minutely scabrous as is the main axis of the panicle. Sheaths loose and crowded at the base, minutely scabrous. Ligule about 1 mm. in length. Leaf-blades of the sterile shoots 5 to 20 cm. long; those of the culm, two or three, the uppermost rarely exceeding 1 cm. in length, sometimes reduced to a mucronate point, lowermost rarely more than 1 cm. long, 1 to 2 mm. wide, minutely scabrous above and below, conspicuously roughened near the rigid apex. Panicle branches 1 to 2 cm. long, the shorter ones flower-bearing to the base. Pedicels scabrous. Spikelets narrowly oblong-lanceolate, somewhat compressed, usually about 6 mm. long, 3- to 5-flowered. Outer glumes minutely scabrous on the keels, the first 2-nerved, the broader second glume 3-nerved, with broadly subhyaline margins. Flowering glumes about 4 mm. long, minutely roughened on the keel, especially near the apex and finely pubescent on the dorsal and marginal nerves near the base. Intermediate nerves indistinct. Palea shorter than the flowering glume, scabrous on the nerves, and very minutely pubescent between them, the apex hyaline, adherent to the grain.

Loose, gravelly soil, summit of Sheep Mountain, Laramie, Albany County, Wyo., altitude 2,700 meters (Aven Nelson, July 3, 1897). Rather scarce.

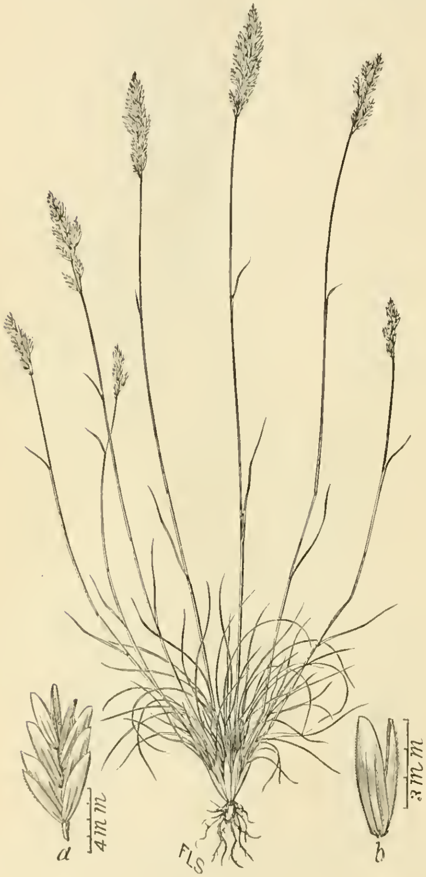


FIG. 11.—*Poa capillaris* Scribn.: *a*, spikelet; *b*, floret.

AGROPYRON ELMERI Scribn., sp. n. (Pl. XII.)

A stout, erect perennial, 9 to 15 dm. high, from strong creeping rootstocks, with rather narrow, flat, erect, or ascending leaves and spikes 15 to 20 cm. long. Culms smooth. Sheaths smooth, lower ones longer than the internodes. Ligule about 1 mm. long, minutely fringed along the edge, auricled. Lower leaves 20 cm. long, the upper ones shorter, 4 to 6 mm. broad, strigose-scabrous above, smooth beneath, long attenuate-pointed; leaves of the innovations longer and narrower. Axis of the spike not readily breaking up. Spikelets approximate but not crowded, compressed, 6- to 10-flowered; empty glumes lanceolate, very acute, or subaristate-pointed, rigid, subequal, about 12 mm. long, 3-nerved, scabrous on the nerves. First flowering glume very firm in texture, a little longer than the empty ones, broadly lanceolate, sharply acuminate or subaristate-pointed, 5-nerved, nerves visible only near the apex, scabrous on the back, and covered with a short pubescence which is most conspicuous near the base and margins. Palea nearly as long as the glume, oblong-lanceolate, strongly two-keeled, keels very firm and rigid and minutely aculeolate-scabrous excepting toward the base, apex truncate and minutely pubescent. Stamens 5 mm. long.

On sandy bars and banks, Snake River, Washington, not plentiful (No. 759, A. D. E. Elmer, June, 1897).

This species is chiefly distinguished from *Agropyron spicatum* by its stouter, taller, and straw-like culms and larger spikelets. Some robust forms of *Agropyron spicatum*, as, for example, No. 2271, P. A. Rydberg, July 27, 1895, are hardly to be distinguished from this species, so far as the character of the spike and spikelets are concerned. The coarse, straw-like culms of *Agropyron elmeri* may be due to the nature of the soil in which the plants grew.

AGROPYRON BREVIFOLIUM Scribn., sp. n. (Pl. XIII.)

A slender, densely caespitose species with the smooth culms, which are from 3 to 4 dm. high, usually geniculate at the lower joints, rather short, flat leaves and slender spikes 4 to 8 cm. long. Lowermost sheaths scarious and somewhat purplish, glabrous and smooth. Ligule short, usually with long sickle-shaped auricles. Leaf-blades of the culm leaves 3 to 6 or 7 cm. long, 2 to 4 mm. wide. Those on the innovations somewhat longer and narrower, all very acute, upper surface minutely strigose-scabrous, very smooth beneath. Axis of the spike readily breaking up. Spikelets approximate, usually 3-flowered, 10 to 15 mm. long. Empty glumes subequal, or the first a little shorter than the second, narrowly lanceolate short awn-pointed, 2- to 3-nerved, scabrous on the keel. Flowering glumes of the first floret about 1 cm. long, 5-nerved, nerves slightly conspicuous near the apex, scabrous on the back, especially toward the tip, which is entire or slightly 2-toothed, the midvein extending into an awn 2 to 4 mm. long. Palea as long as the glume, oblong-lanceolate, truncate, minutely aculeolate-scabrous along the sharp keels excepting near the base; the truncate apex minutely pubescent.

Mountain sides, North Fork Bridge Creek, altitude 1,800 meters, Washington State (No. 676, A. D. E. Elmer, September, 1897).

Allied to *Agropyron violaceum;* readily distinguished by its narrower glumes and shorter, narrow leaves.

ELYMUS CAPITATUS Scribn., sp. n. (Plate XIV.)

A stout, coarse, glaucous perennial with loose sheaths, rather broad, flat leaves and densely flowered, ovate or oblong spikes 8 to 15 cm. long. Culms about 6 dm. high, softly pubescent below the inflorescence, otherwise glabrous. Sheaths glabrous, striate, smooth. Ligule very short, irregularly cut and minutely fringed along the edge. Leaf-blades varying in width from 2 or 3 mm. in the sterile shoots to 1 or 2 cm. in those of the culm, attenuate-pointed, glabrous and smooth beneath, strigose-scabrous above, apex very sharp and rigid. Spikelets about 2.5 to 3 cm. long, compressed, 3- to 5-flowered. Glumes finely and closely pubescent, sparingly pilose with longer hairs. Outer glumes lanceolate-acuminate, a little shorter than the spikelet, 2 to 3 mm. broad, with scarious margins. Flowering glumes 20 to 25 mm. long, acuminate-pointed, 7-nerved, with broad scarious margins, apex mucronate-pointed, acute, or slightly rounded; palea a little shorter than the glume, finely and closely pubescent on the back and on the rather broad margins. Grain linear, as long as the palea which loosely embraces it.

Growing with *E. mollis* and other grasses at Homer, Alaska (No. 471, Walter Evans, July 27, 1897).

This striking species is remarkable for its thick spikes, which are 3 to 4 cm. in diameter. The culms are not so tall as those of *E. mollis* growing with it; the spikes are shorter and much thicker. The glumes in *E. mollis* are pubescent with rather long, soft hairs, while the glumes of *E. capitatus* are covered with a very short and close pubescence, which is only visible under the lens. There is a variety of *E. mollis* (*E. mollis brevispicus* Scribn. & Smith) from St. Lawrence Bay which has something of the habit of *E. capitatus*, but the spikes, while only 7 to 10 cm. long, are not so thick, and the glumes are rather densely clothed with a long pubescence very unlike that of *E. capitatus*.

ELYMUS HANSENI Scribn., sp. n. (Fig. 12.)

A rather stout, glabrous perennial 9 to 12 dm. high, narrow, spreading leaves and slender, fragile spikes 5 to 8 cm. long. Sheaths smooth, striate. Ligule very short, hardly 1 mm. in length, entire. Leaf-blades 10 to 30 cm. long, 2 to 5 mm. wide. Internodes of the axis of the spike about 1 cm. in length. Spikelets 3- to 5-flowered, about 1.5 mm. long, exclusive of the awns. Empty glumes lanceolate, strongly nerved, tipped with 2, sometimes 3, unequal awns; the longer awns of the empty glumes about 3.5 cm. long. First flowering glume 10 to 12 mm. long, entire or 2-toothed at the apex, terminating in a straight and very slender awn about 5 cm. long. Palea about the length of the glume, minutely scabrous on the sharp keels except near the base, slightly pubescent at the truncate or 2-toothed apex.

Dry, open ground, agricultural station in Amador County, Cal. (No. 1742, George Hansen, June 17, 1896). Allied to *Sitanion elymoides*, but is a much taller grass with narrower leaves, more slender spikes, larger spikelets, broader empty glumes, and awns not divergent. The palea is also much broader at the apex and not awned.

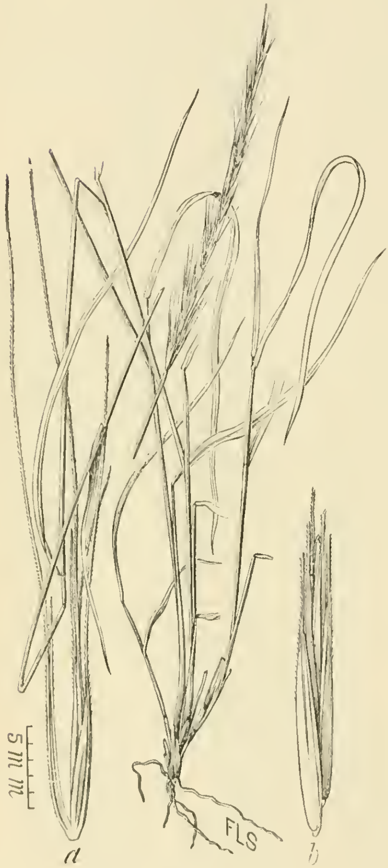


Fig. 12.—*Elymus hanseni* Scribn.: *a*, empty glumes; *b*, spikelet with the empty glumes and awns removed.

ELYMUS SAXICOLUS Scribn. & Smith, sp. n. (Pl. XV.)

A rather slender, wiry, densely cæspitose perennial about 5 dm. high softly pubescent sheaths and leaves and fragile spikes, 5 to 10 cm. long. Culms pubescent excepting where covered by the leaf-sheaths. Sheaths pubescent. Ligule very short, scarious, auricled. Leaf-blades 10 to 20 cm. long, the uppermost 5 to 6 cm. long, long attenuate-pointed, 3 to 4 mm. wide or less, strongly striate above and pubescent on both sides. Axis of the panicle strongly compressed, readily breaking up. Spikelets solitary or in pairs, 2- to 5-flowered, about 1.5 cm. long exclusive of the awns. Outer glumes narrowly lanceolate, 1- to 3-nerved, about 6 mm. long. Awn slender, divergent, 1.5 to 2 cm. long. First flowering glume about 1 cm. long, smooth or slightly scabrous near the apex, rather broadly lanceolate and gradually tapering into a slender, flexuous, more or less divergent awn, 2 to 2.5 cm. long. Palea as long as its glume, finely aculeolate-scabrous on the keels. Apex rounded-obtuse or truncate and pubescent.

Among bowlders and rocky crevices on the summit of Mount Chapaca, altitude 1,900 meters (No. 554, A. D. E. Elmer, August, 1897). Distributed as *Agropyron saxicolum.* This grass was at first taken to be a species of *Agropyron*, but an examination of further material determines its position as an *Elymus.* In many of the spikes the spikelets are all solitary, but the position of the first flowering glume in being slightly turned to one side in its relation to the main axis is a character of the genus *Elymus*, and there are frequently entire spikes where the spikelets are all in pairs as in the typical species of the genus. The soft, hoary pubescence and slender divergent awns are the most striking characters of this species.

ELYMUS CILIATUS Scribn., sp. n. (Pl. XVI.)

A rather slender, erect perennial about 7 dm. high with soft, flat leaves and slender, nodding spikes, 7 to 12 cm. long. Culms very smooth. Sheaths smooth, striate. Ligule less than 1 mm. long. Leaf-blades linear, lanceolate, 12 to 18 cm. long, nearly 1 cm. broad, scabrous on both sides and especially on the margins. Axis of the panicle strongly scabrous. Spikelets about 1.5 cm. long, exclusive of the awn, 2- to 3-flowered. Empty glumes lanceolate, 3-nerved, about 8 mm. long exclusive of the awn, which is 3 to 4 mm. long; the outer pair of glumes ciliate near the apex, the inner pair usually naked. The first flowering glume about 1 cm. long, 5-nerved, nerves prominent near the base, ciliate-pubescent along the margins, especially near the apex. Awns straight or somewhat flexuous, 2 to 2.5 cm. long. Palea about as long as the glume, finely aculeolate-scabrous along the margins near the 2-toothed apex.

Common in wet places, Sitka, Alaska (No. 210, Walter Evans, June, 1897; No. 1724 Howell). This species is related to *Elymus sibiricus*, from which it is distinguished by its longer and broader outer glumes and the ciliate margins of the flowering glumes. This latter character serves to distinguish this species from all others with which the writer is acquainted.

ELYMUS SIMPLEX Scribn. & Williams, sp. n. (Pl. XVII.)

A rigid species, 3 to 4 dm. high, the erect stems from strong, creeping rootstocks, with flat, pungently-pointed rigid leaves and densely flowered spikes 5 to 8 cm. long. Culms branching at the very base, growing in thin, scattered tufts. Lower sheaths crowded, exceeding the internodes, glabrous and smooth. Ligule very short, auricled. Leaf-blades 4 to 10 mm. long, 3 to 6 mm. broad, becoming involute when dry, smooth the lower surface strigose-scabrous above, the very sharp, involute tips straw-colored. Axis of the panicle scabrous, strongly flattened and scabrous on the edges, not readily breaking up. Spikes solitary or in pairs, sessile and shortly pedicellate, slightly compressed, usually crowded, rarely remote, about 1.5 cm. long, 5- to 7- (or more in var. *luxurians*) flowered. Empty glumes slightly unequal, very rigid, the longer one about 1 cm. in length, narrowly lanceolate, very rigid and long subulate-pointed. First flowering glume about 7 mm. long, rounded on the back, smooth, more or less glaucous, extending into a rigid awn, 5 to 6 mm. long. Palea deeply sulcate toward the base, about as long as its glume, aculeolate-scabrous on the strong keels, excepting near the base. Apex narrow, minutely 2-toothed, very minutely scabrous or subpubescent on the back.

Type specimen is represented by No. 2334, Thomas A. Williams, collected on banks of Green River, Wyoming, July 8, 1897, altitude 1,800 meters. No. 2366 of the same collection belongs here. This was collected on edges of ponds and along river bottoms in the same vicinity, growing with *Distichlis spicata.*

ELYMUS SIMPLEX var. **LUXURIANS** Scribn. & Williams, var. n.

Is glaucous throughout with stouter culms, longer and broader leaves and narrower panicles, which are often branched, and with spikelets sometimes 10- to 12-flowered. This variety is represented by No. 2338, Thomas A. Williams, which was found growing in rich soil along streams, common near Green River, Wyoming, July 8, 1897.

ELYMUS HIRSUTIGLUMIS Scribn., n. n., *E. intermedius* Scribn. & Smith; Bull. 4, Div. Agros. 38 (1897), not *E. intermedius* Bieb., Flor. **1**: 82.

EXPLANATION OF PLATES.

PLATE I. *Panicum linearifolium* Scribn.: *a*, spikelet seen from the anterior side; *b*, spikelet seen from the dorsal side showing second glume; *c*, anterior face of third glume showing imperfect palea; *d*, dorsal view of flowering glume; *e*, anterior view of flowering glume showing palea.

II. *Panicum equilaterale* Scribn.: *a*, spikelets seen from the anterior side showing first and second glumes; *b*, spikelet seen from the dorsal side showing second glume; *c*, lateral view of spikelet showing base of the fourth glume; *d*, third glume, with the palea; *e*, flowering glume, dorsal view; *f*, anterior view of fourth glume showing palea.

III. *Chætochloa latifolia* Scribn.: *a*, spikelet seen from the side showing bristle; *b*, spikelet seen from the anterior side showing first and second glumes; *c*, spikelet seen from the back showing base of first glume, back of second glume, and apex of fourth glume; *d*, dorsal view of fruiting glume.

IV. *Stipa williamsii* Scribn.: *a*, empty glumes; *b*, floret.

V. *Sporobolus palmeri* Scribn.: *a*, empty glumes; *b*, spikelets with the empty glumes removed.

VI. *Zeugites pringlei* Scribn.: *a*, spikelet showing one perfect and one staminate floret; *b*, empty glumes of the spikelet; *c*, flowering glume of the female floret with the awn partly removed showing a joint of the rachilla at *g*; *d*, dorsal view of the first empty glume; *e*, dorsal view of the second empty glume; *f*, palea of the female floret.

VII. *Eragrostis viscosa* Scribn.: *a*, empty glumes; *b*, spikelet with the empty glumes removed; *c*, palea.

VIII. *Poa juncifolia* Scribn.: *a*, empty glumes; *b*, florets of spikelet seen from the side; *c*, dorsal view of flowering glume; *d*, palea; *e*, base of leaf and upper portion of sheath showing palea.

IX. *Poa hanseni* Scribn.: *a*, empty glumes; *b*, three florets seen from the side; *c*, ligule.

X. *Poa atropurpurea* Scribn.: *a*, empty glumes; *b*, four florets seen from the side; *c*, single floret seen from the side.

XI. *Poa longepedunculata* Scribn.: *a*, empty glumes; *b*, three florets seen from the side; *c*, base of the leaf and portion of sheath showing ligule.

XII. *Agropyron elmeri* Scribn.: *a*, empty glumes; *b*, spikelet with the empty glumes removed.

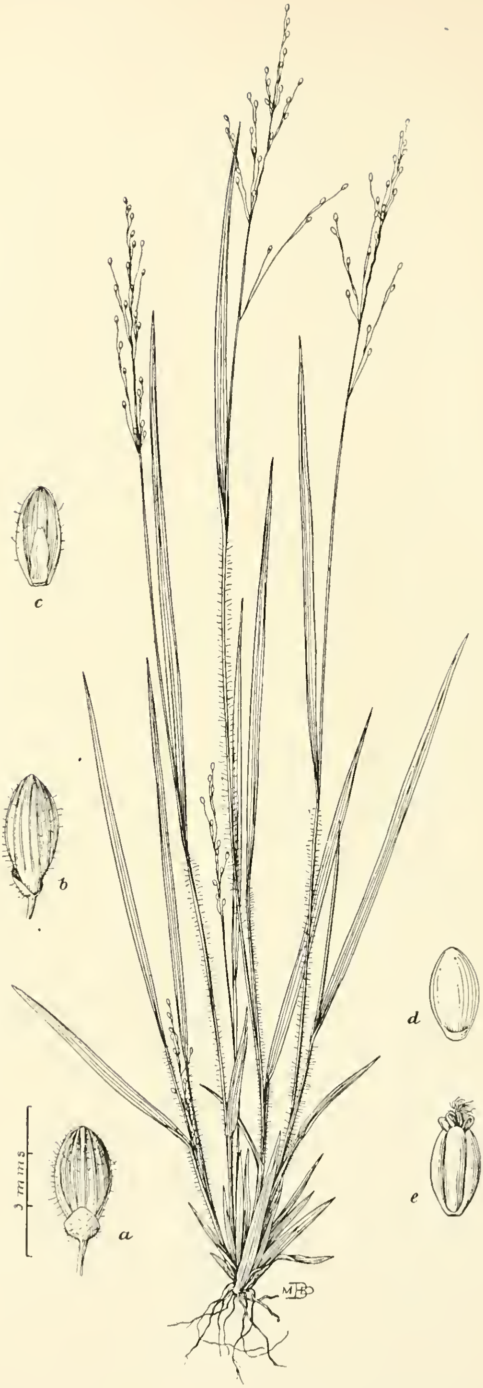
XIII. *Agropyron brevifolium* Scribn.: *a*, empty glumes; *b*, spikelet with the empty glumes removed.

XIV. *Elymus capitatus* Scribn.: *a*, spikelet; *b*, one of the florets.

XV. *Elymus saxicolus* Scribn. & Smith: *a*, a pair of empty glumes with the awns removed; *b*, spikelet with the empty glumes removed and the awns partly cut off.

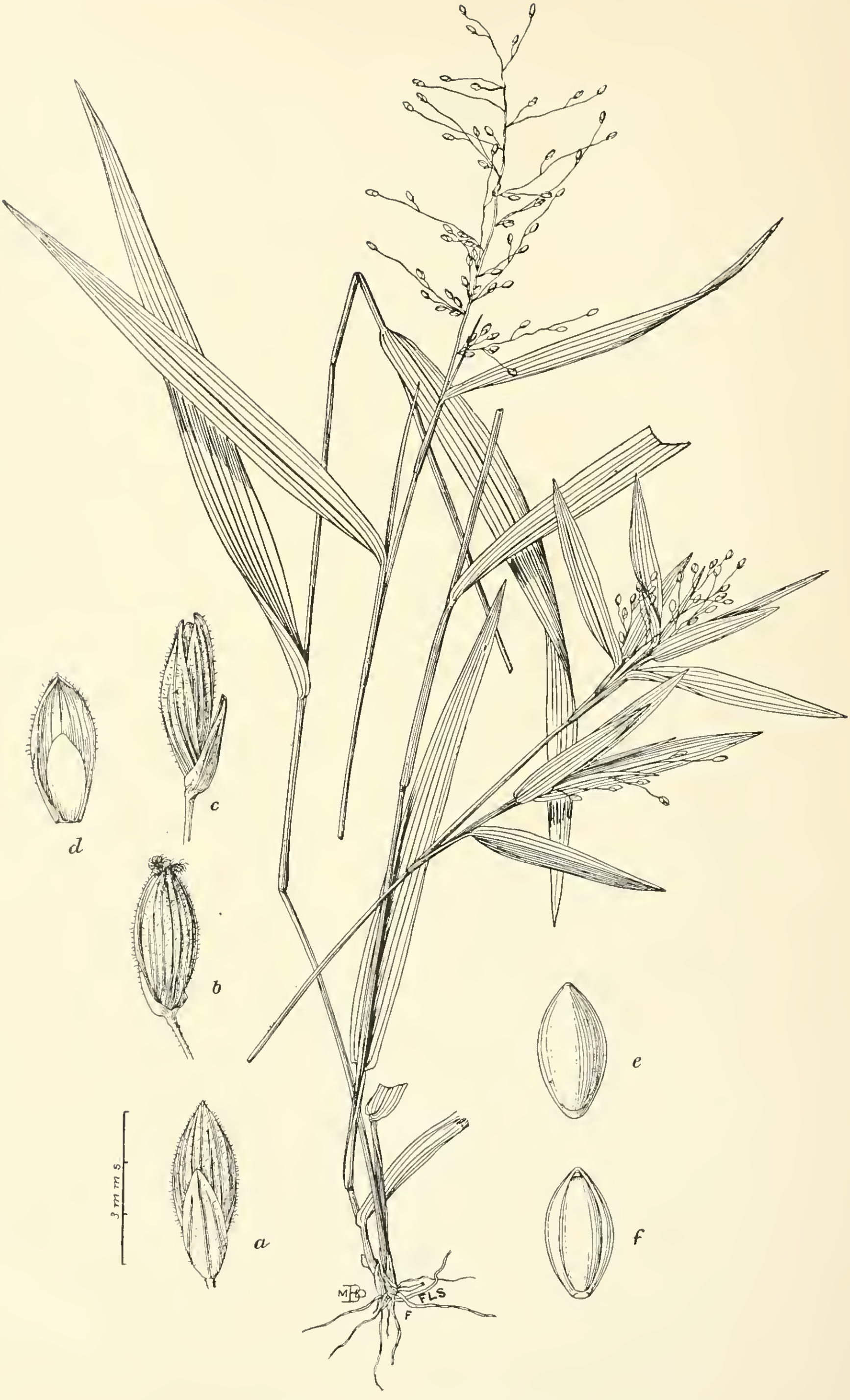
XVI. *Elymus ciliatus* Scribn.: *a*, empty glumes; *b*, florets with the awns partly removed.

XVII. *Elymus simplex* Scribn. & Williams: *a*, empty glumes; *b*, spikelet with the empty glumes removed.

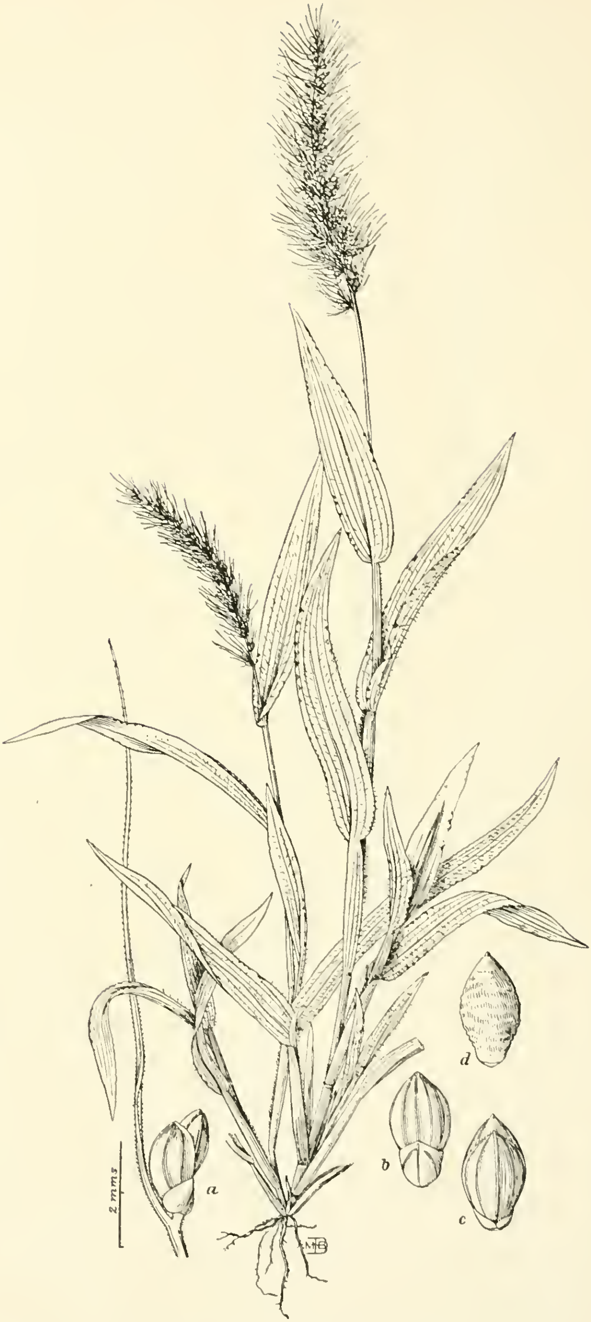

c
b
d
e
a
3 mms
MHB

PANICUM LINEARIFOLIUM SCRIBN.

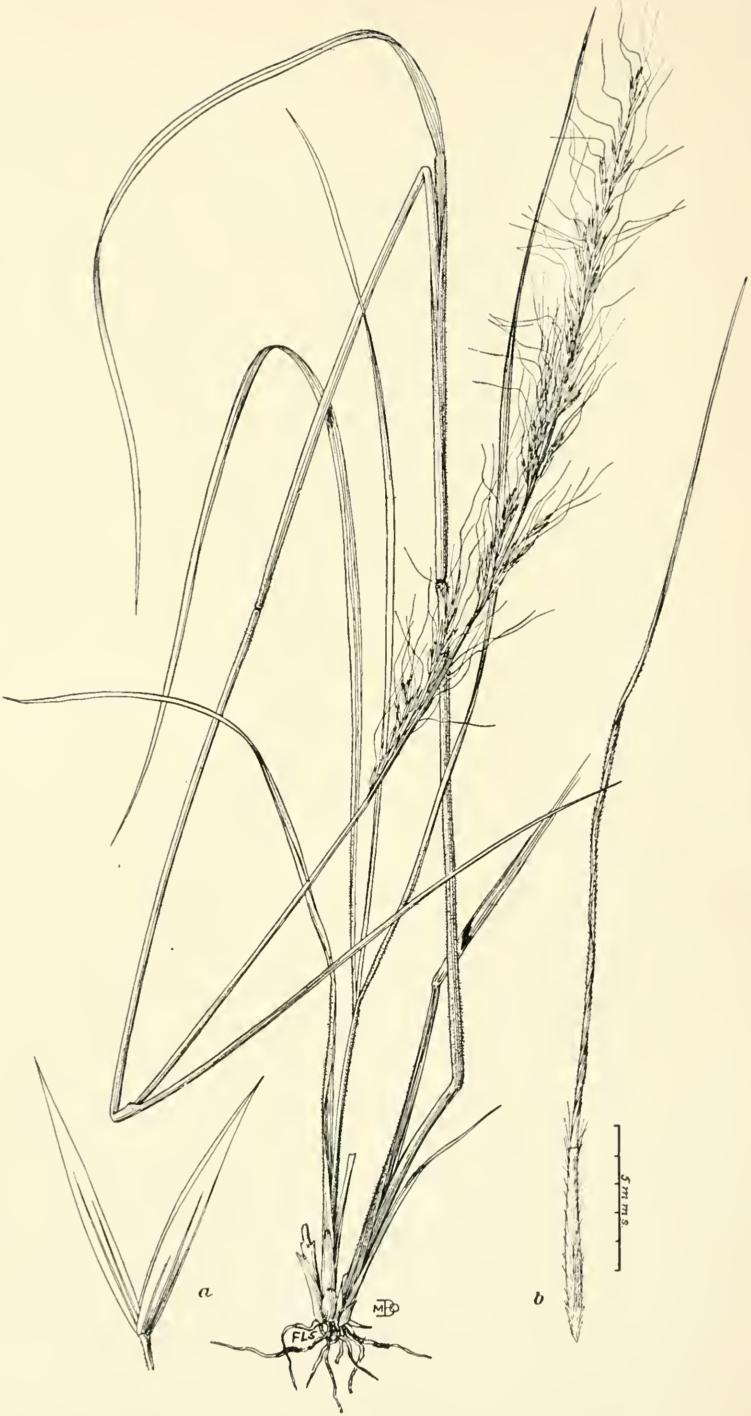
PLATE II.


d
c
b
a
e
f
3 mms
MHB
FLS
F

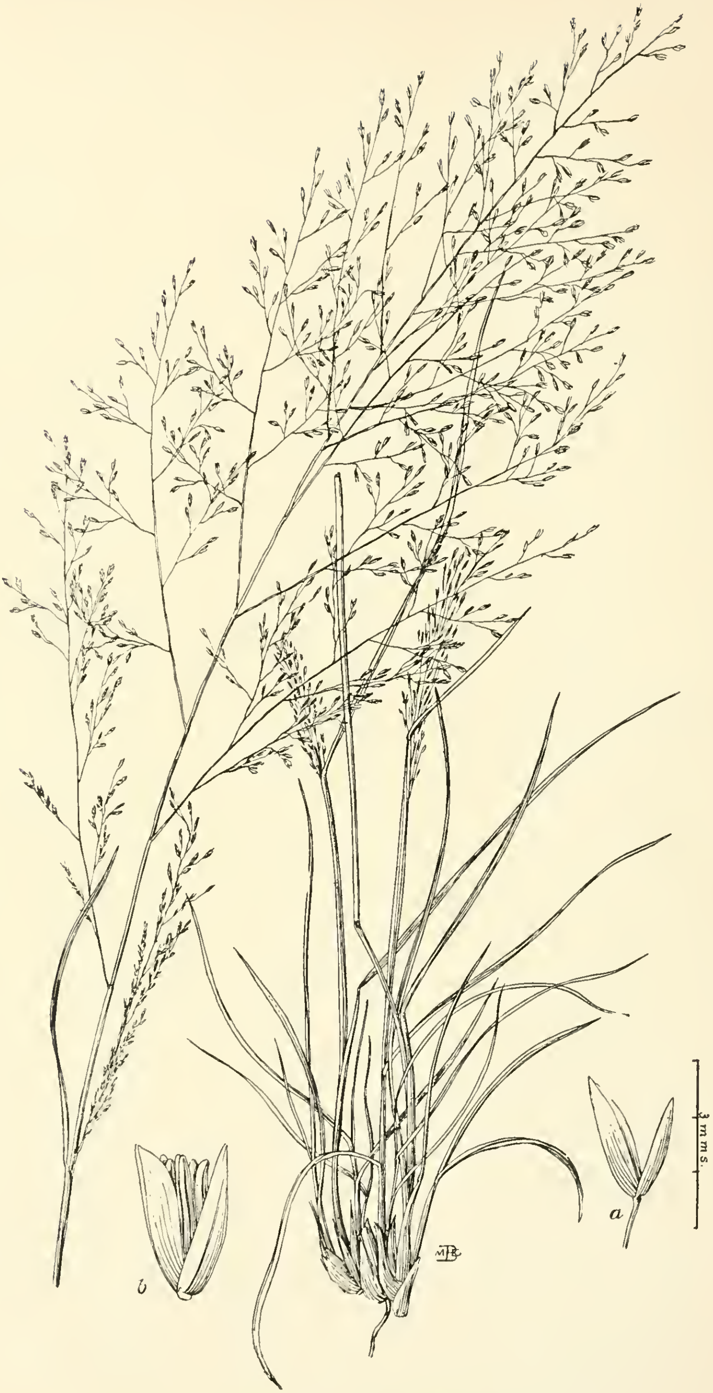
PANICUM EQUILATERALE SCRIBN.


2 mms
a
b
c
d
MB

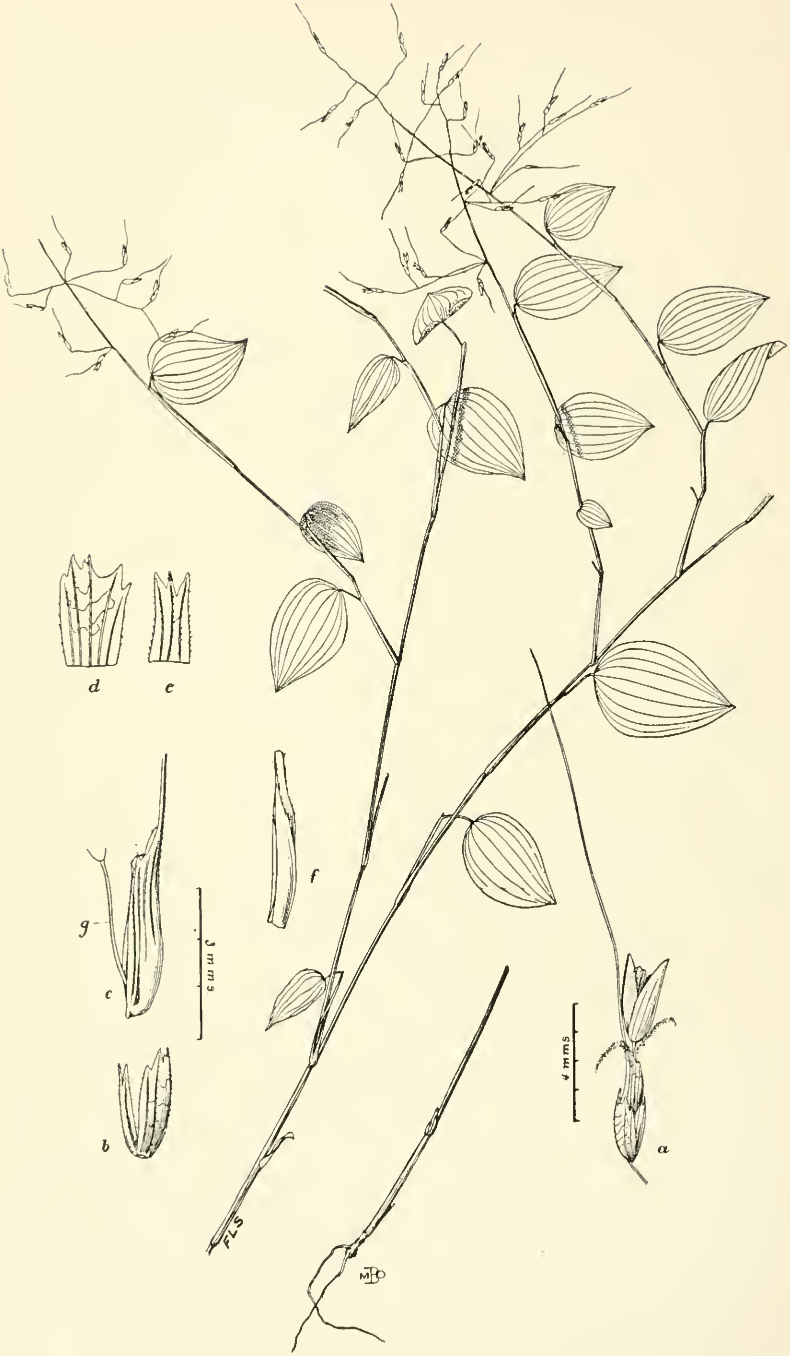
CHÆTOCHLOA LATIFOLIA SCRIBN.


a
b
5 mms.
MB
FLS

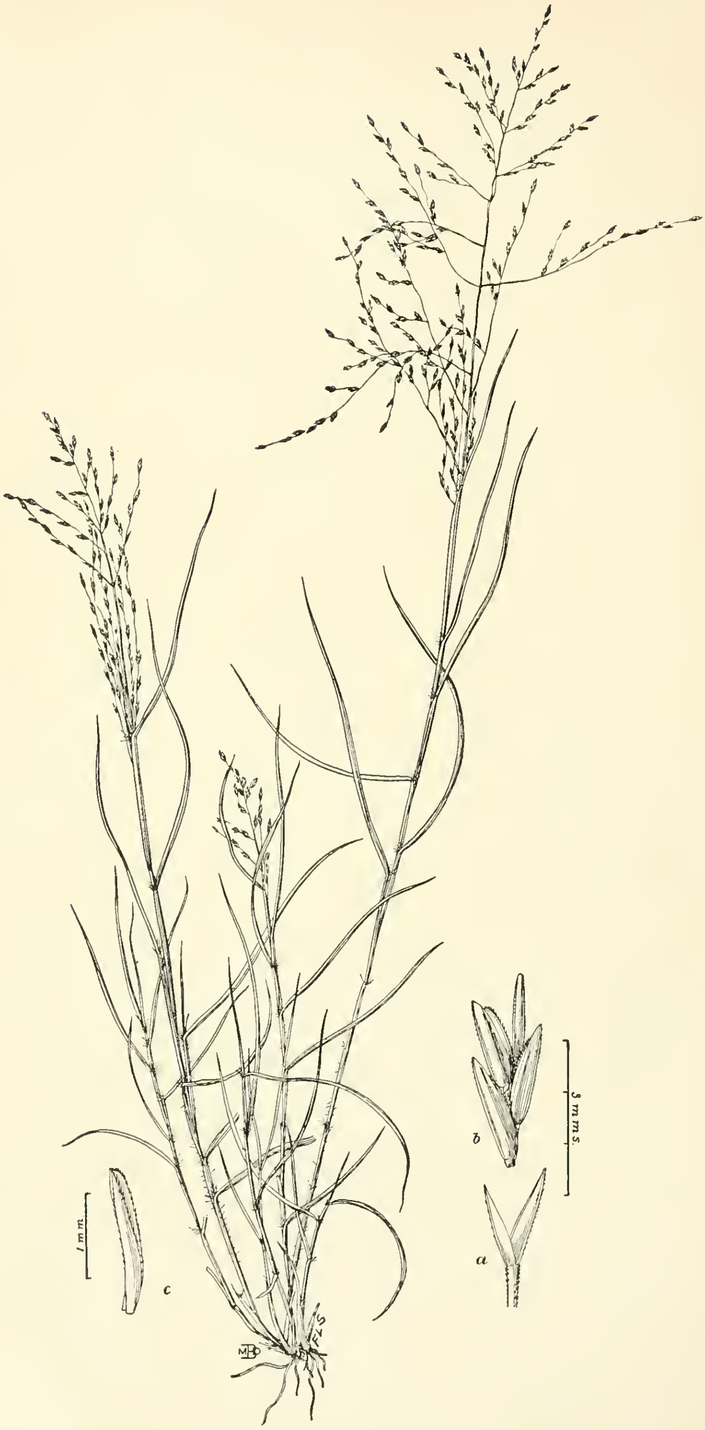
STIPA WILLIAMSII SCRIBN.



Sporobolus palmeri Scribn.

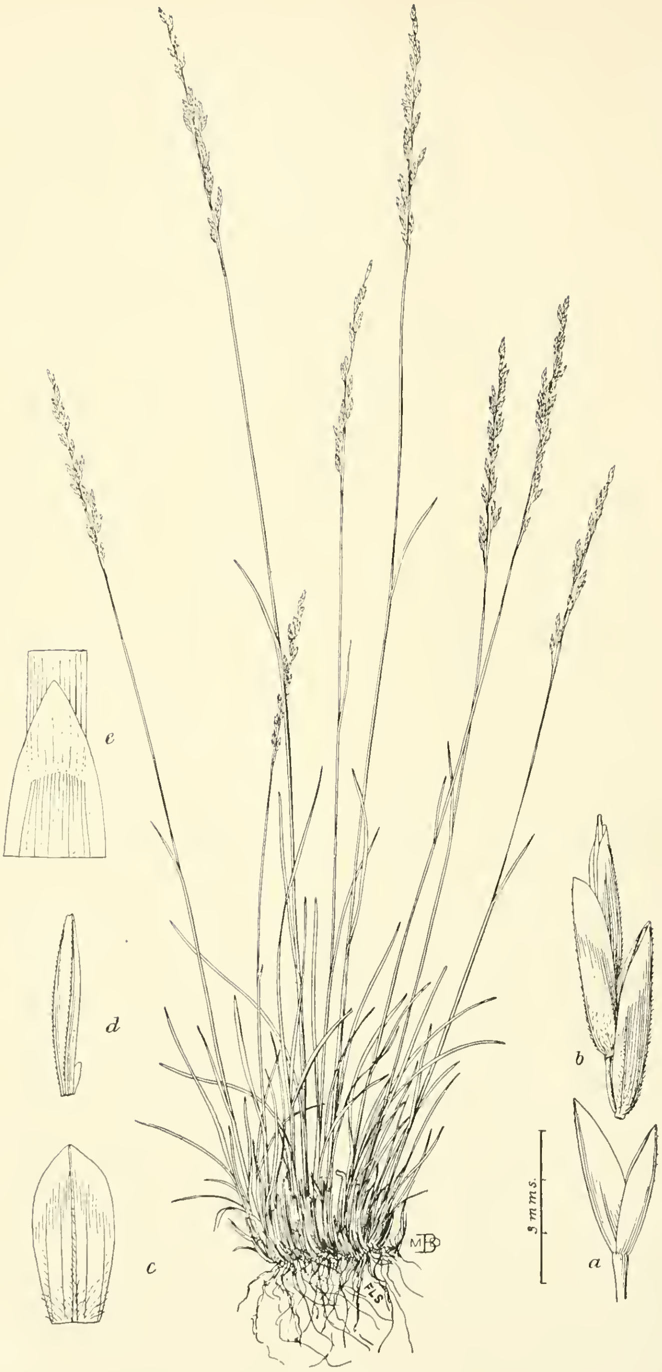

d
e
f
g
c
3 mms
b
4 mms
a
FLS
MBO

ZEUGITES PRINGLEI SCRIBN.

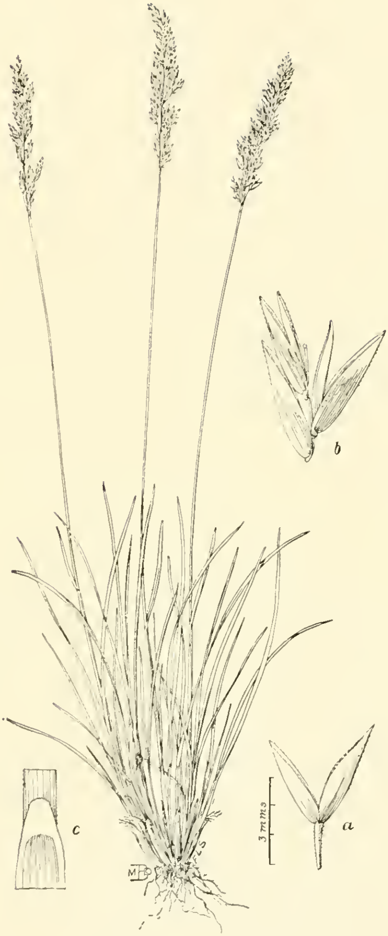

b
3 mms.
a
1 mm.
c
F.L.S
MB

ERAGROSTIS VISCOSA SCRIBN.

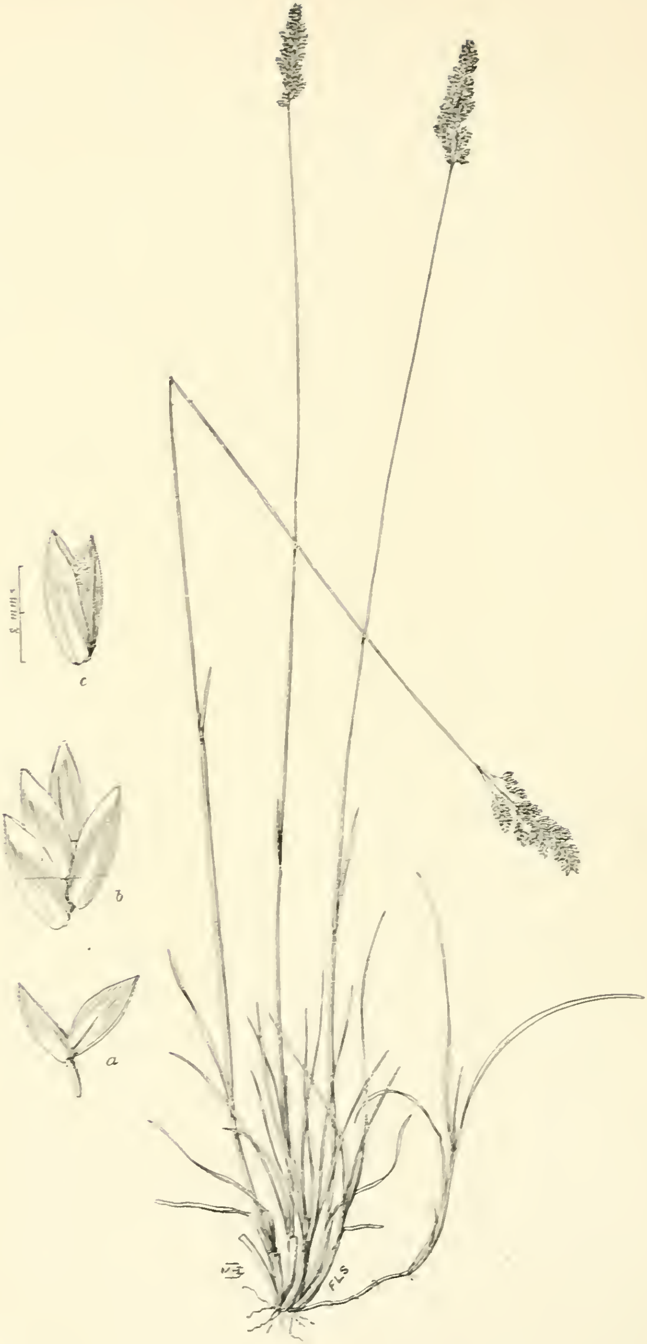
PLATE VIII.


e
d
c
b
a
3 mms.
MB
FLS

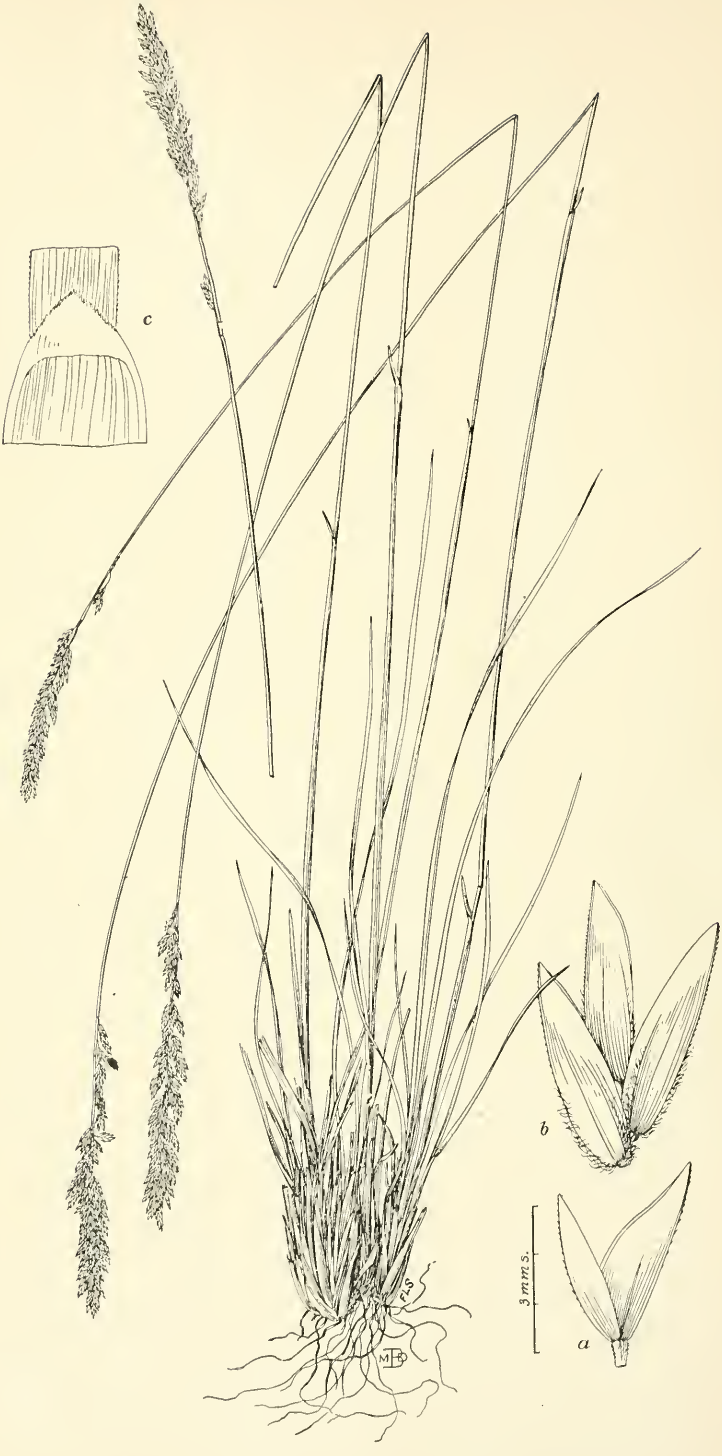
POA JUNCIFOLIA SCRIBN.



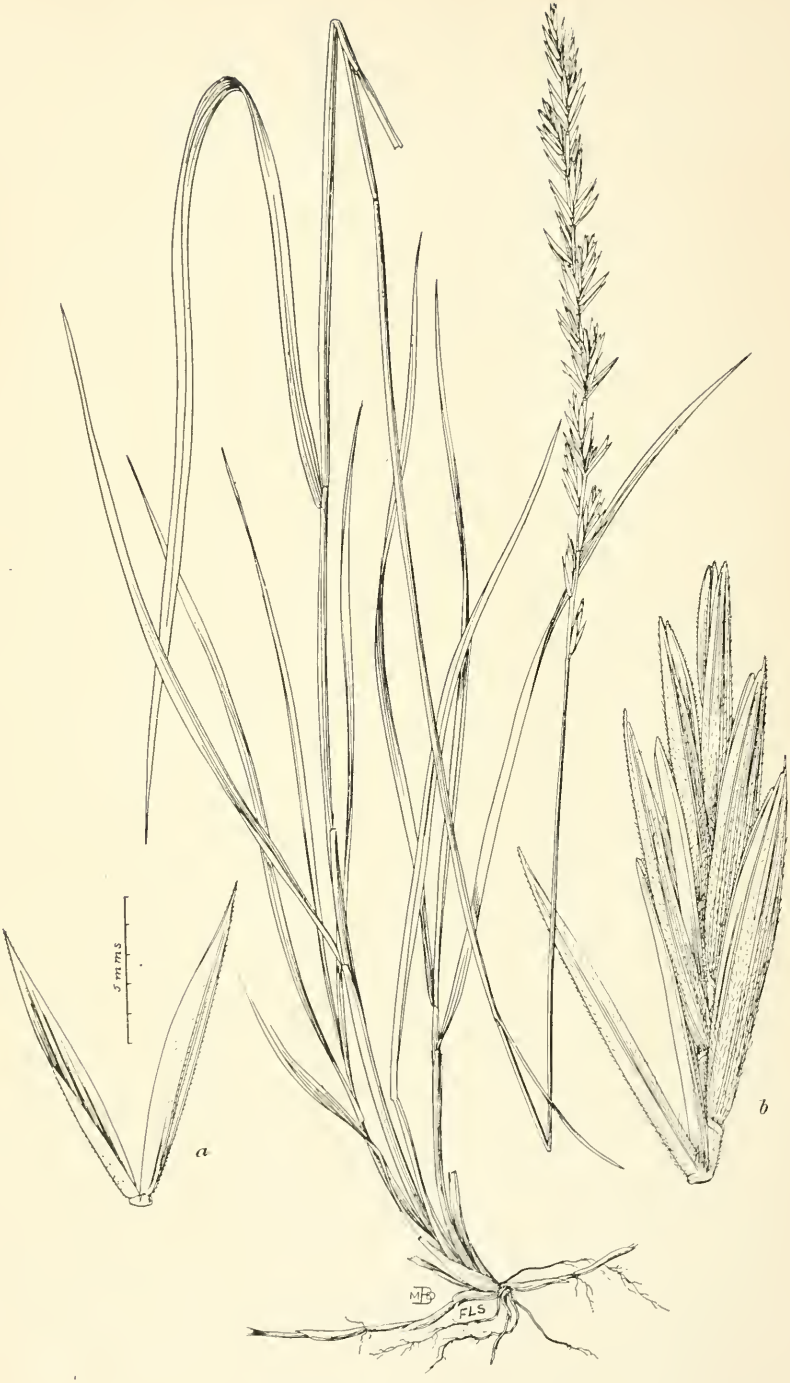
Poa hanseni Scribn.



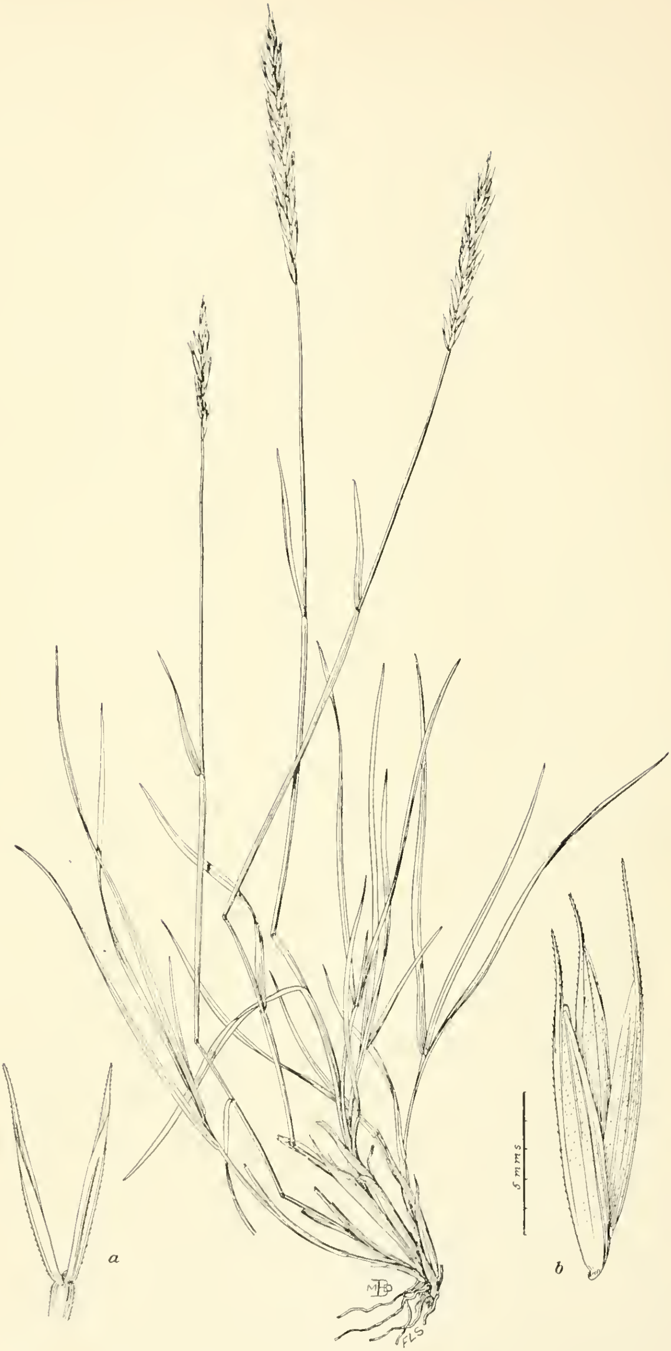
POA ATROPURPUREA SCRIBN.


c
b
3 mms.
a
FLS

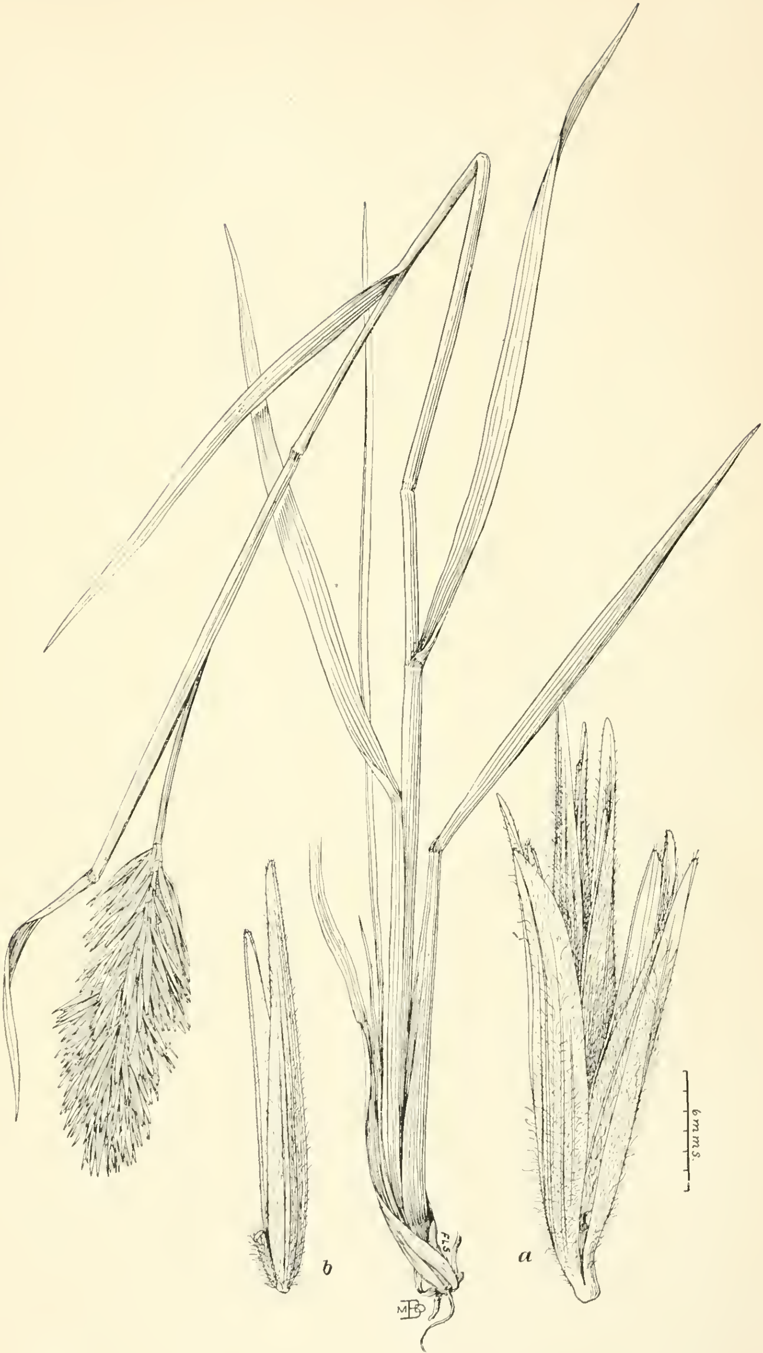
POA LONGEPEDUNCULATA SCRIBN.


5 mms
a
b
FLS
MHD

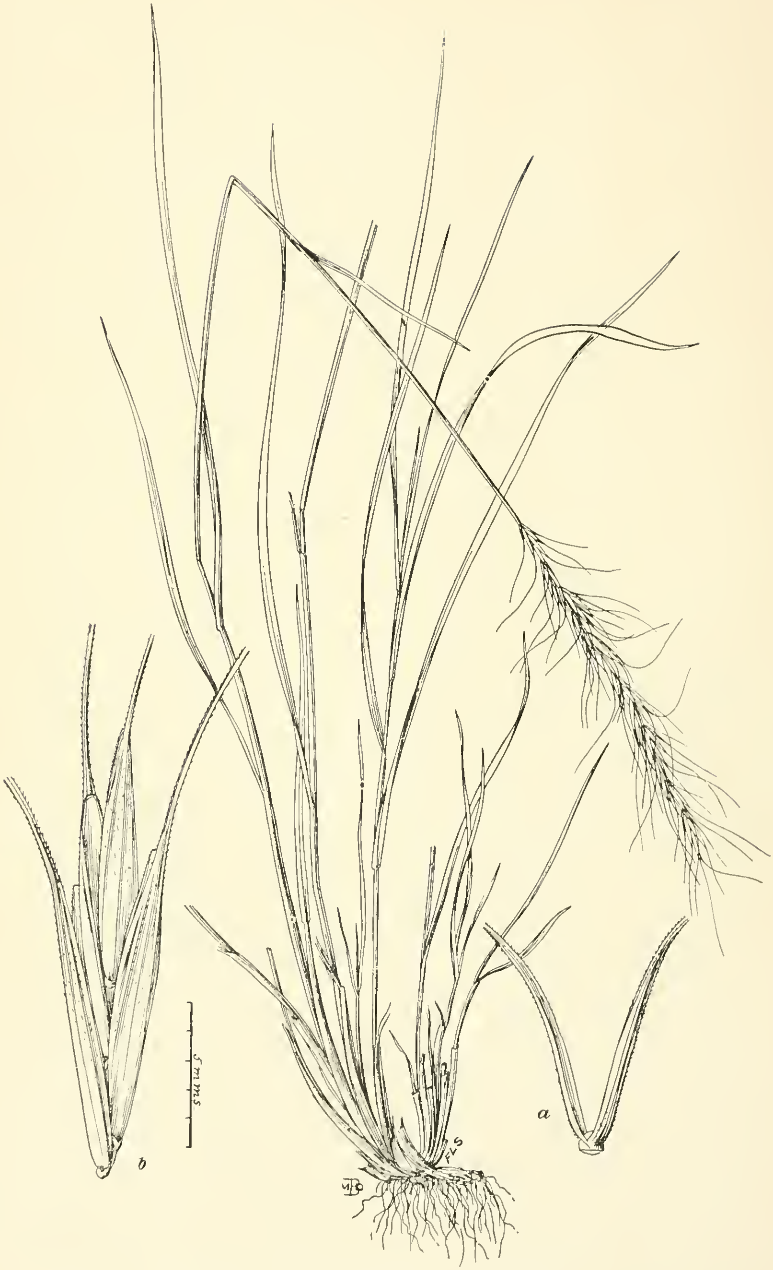
Agropyron elmeri Scribn.



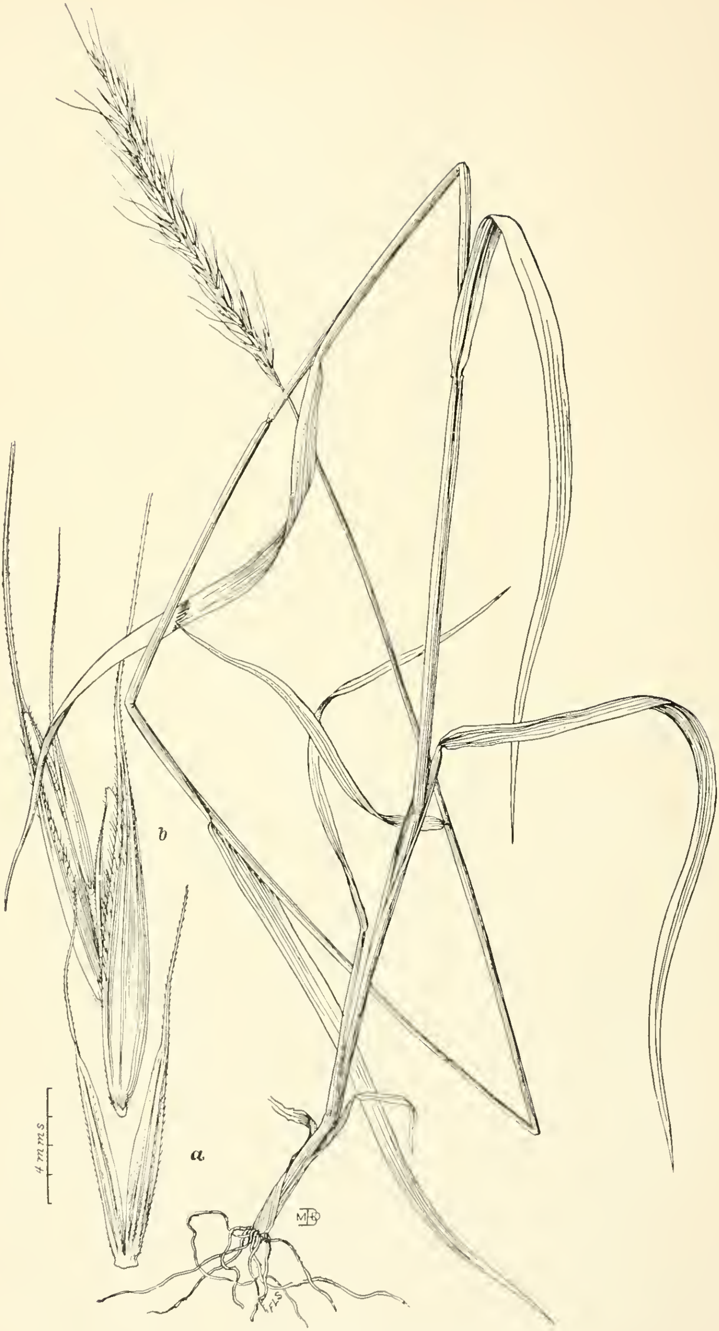
AGROPYRON BREVIFOLIUM SCRIBN.



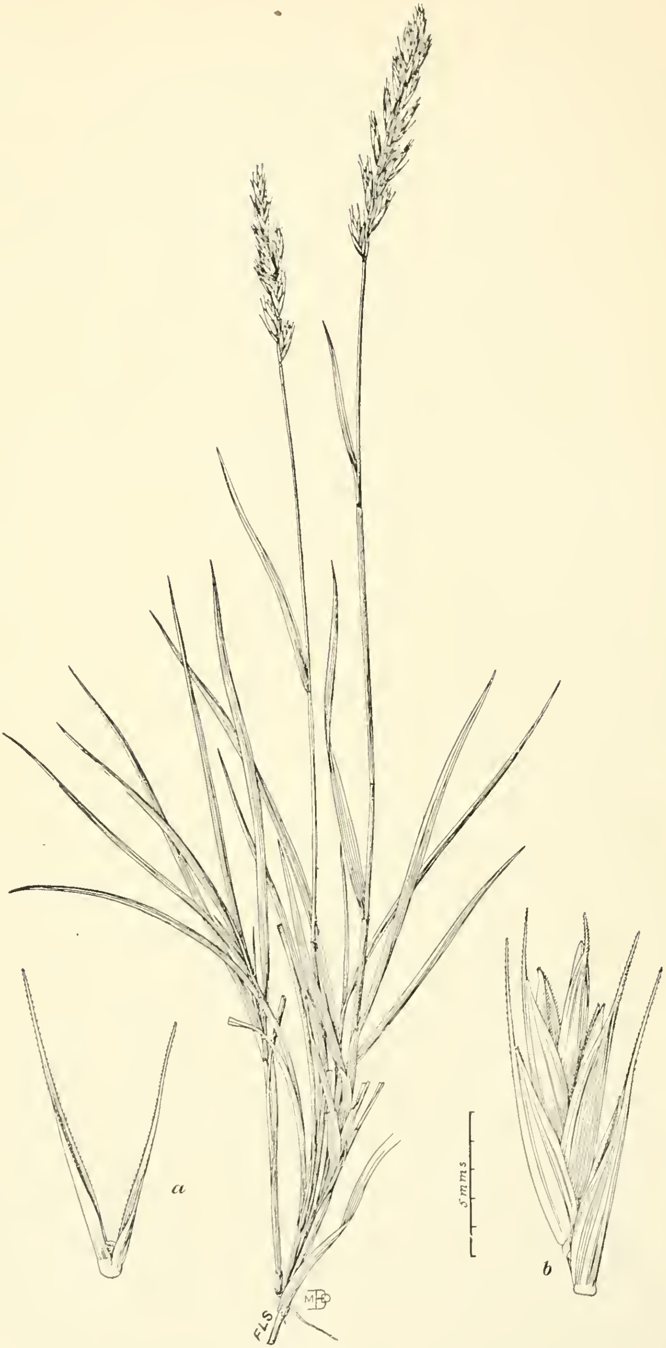
ELYMUS CAPITATUS SCRIBN.


a
b
5 mms
F.L.S.
M.B.

Elymus saxicolus Scribn. and Smith.


b
a
4 mms
MTB
FLS

ELYMUS CILIATUS SCRIBN.



ELYMUS SIMPLEX SCRIBN. AND WILLIAMS.

INDEX.

[Synonyms in *italics*.]

Page.

- Agropyron brevifolium 55
  - elmeri 54
  - *saxicolum* 57
  - spicatum 55
  - violaceum 55
- Agrostis æquivalvis 13
  - *glauca* 33
  - *mexicana* 28
  - paludosa 49-50
- *Aira melicoides* 50
- *Arundo agrostoides* 28
  - *canadensis* 28, 33
  - *cinnoides* 33
  - *coarctata* 33
  - *confinis* 37
  - *fissa* 28
  - *glauca* 33
  - *langsdorffii* 27
  - *neglecta* 34
  - *stricta* 33, 34
  - *sylvatica* 37
- *Calamagrostis agrostoides* 28
  - alaskana 32
  - *albicans* 20
  - aleutica 20, 22
    - *angusta* 21
    - patens 20
  - *americana* 41
  - andina 13
  - angusta 21, 22
  - *arctica* 19
  - blanda 28
  - bolanderi 15, 16
  - *borealis* 35
  - breviseta 25, 26
    - debilis 25
    - lacustris 25
  - breweri 17
  - californica 37
  - *canadensis* 32, 33
  - canadensis 27, 28, 30, 31
    - acuminata 29, 32
    - campestris 31
    - *dubia* 31
    - *robusta* 29
  - cinnoides 33
  - *coarctata* 33, 34
  - columbiensis 27, 28
  - *confinis* 37
  - crassiglumis 41
  - cusickii 24, 32
  - *densa* 20
  - deschampsioides 16, 17
  - *dubia* 31

Page.

- Calamagrostis fasciculata 23
  - foliosa 17, 18
  - gigantea 13
  - *glauca* 33
  - *hirtigluma* 27
  - holmii 35
  - howellii 17-19
  - *hyperborea* 42
  - hyperborea 35, 39, 40
    - elongata 37
    - elongata 40
    - stenodes 39
  - inexpansa 37, 40
    - barbulata 37
    - cuprea 37
  - koelerioides 21
    - *densa* 20
  - labradorica 38
  - *lactea* 28
  - langsdorffii 27, 30, 32
    - lactea 28
    - *marylandica* 33
  - *lapponica* 34
  - lapponica 25, 32, 35
  - laxiflora 34
  - lemmoni 16
  - *longifolia* 17
  - macouniana 31
  - *mexicana* 28
  - *michauxii* 29
  - micrantha 36
  - montanensis 20
  - neglecta 34, 36, 40
    - borealis 35
    - candidula 35
    - *confinis* 37
    - *crassiglumis* 41
    - *gracilis* 34
    - wrightii 36
  - nemoralis 26
  - *nutkaensis* 20
  - *nuttalliana* 34
  - *obtusata* 16
  - *oregonensis* 27
  - oregonensis 28
  - *pallida* 20, 28
  - *pickeringii* 25
  - *porteri* 26, 27
  - porteri 37
  - *purpurascens* 19
  - purpurascens 18
    - arctica 19
  - *robusta* 39
  - rubescens 24

Page.

- *Calamagrostis scabra* 27
  - scopulorum 33
    - lucidula 33
  - scribneri 31
  - *stricta* 34, 41
    - *borealis* 35
    - *robusta* 39
  - strigosa 35
  - *strigosa* 36
  - subflexuosa 22
  - suksdorfii 22, 24, 33
    - luxurians 24
  - *sylvatica* 18
  - sylvatica 19, 37
    - *americana* 18
    - *breviseta* 25
    - *longifolia* 17
    - *purpurascens* 18
  - tweedyi 19
  - *varia* 15
  - vaseyi 17, 19
  - vilfæformis 20, 21
- Chætochloa latifolia 44
- *Cinna (?) purshii* 28
- *Deyeuxia aleutica* 20
  - *bolanderi* 15
  - *borealis* 35
  - *breviaristata* 20
  - *breweri* 17
  - *canadensis* 29
  - *canadensis* 37
  - *cusickii* 32
  - *densa* 21
  - *deschampsioides* 16
  - *dubia* 31
  - *halleriana* 27
  - *longifolia* 17
  - *lactea* 28
  - *macouniana* 31
  - *montanensis* 20
  - *neglecta* 34
    - *americana* 41
    - *brevifolia* 34
    - *robusta* 40
  - *nutkaensis* 20
  - *nuttalliana* 33
  - *pickeringii* 25
  - *porteri* 26
  - *purpurascens* 18
  - *rubescens* 24
  - *suksdorfii* 24
  - *sylvatica* 18
  - *tweedyi* 19
  - *vancouverensis* 35
  - *varia* 24
- Distichlis spicata 57
- Elymus capitatus 55, 56
  - ciliatus 57
  - hanseni 56
  - hirsutiglumis 58
  - intermedius 58
  - mollis 56
    - brevispicis 56
  - saxicolus 56
  - sibiricus 57

Page.

- Elymus simplex 57
  - luxurians 57, 58
- Eragrostis viscosa 51
- Festuca ovina 17
- *Graphephorum melicoides* 50
- Muhlenbergia diffusa 47
  - palustris 47
- Panicum atlanticum 43
  - baldwinii 43, 44
  - commutatum 42
  - depauperatum 42
  - *dichotomum nitidum* 43
  - equilaterale 42
  - implicatum 43
  - linearifolium 42
  - *nitidum minor* 43
  - *ramulosum* 43
  - wrightianum 44, 45
- *Phalaris americana* 33
  - *arundinacea* 33
- Poa arida 52
  - atropurpurea 53
  - capillaris 51, 54
  - hanseni 53
  - juncifolia 52
  - longepedunculata 54
  - pringlei 53
  - sandbergii 52
  - unilateralis 54
- Sitanion elymoides 56
- Sporobolus gracillimus 49
  - palmeri 48
  - simplex 48
  - simplex 49
  - thurberi 48
  - utilis 48
- Stipa comata 47
  - *comata intermedia* 47
  - elmeri 46
  - intermedia 47
  - minor 46
  - nelsoni 46
  - pubescens 46
  - *robusta* 46
  - tweedyi 47
  - viridula 46, 47
  - *viridula minor* 46
    - *pubescens* 46
    - *robusta* 46
  - vaseyi 46
  - williamsii 45
- Trisetum argenteum 49-51
  - *brandegei* 50
  - melicoides 50
  - montanum 50
  - muticum 50, 53
  - *subspicatum muticum* 50
  - *wolfii* 50
  - wolfii 52
- *Vilfa filiculmis* 48
- Zeugites americana 51
  - mexicana 51
  - pringlei 50
  - pringlei 51

New York Botanical Garden Library
3 5185 00259 8710